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Management Digest

Carl Julius Abegg of Nestlé: Betting that the world's appetite will keep growing—p14

ANOTHER LOOK AT AUTOMATION

Hard-working, fast-moving Michigan Tractor Shovel takes a 1¼-cu.-yd. bite of sand at Palmetto Quarries, Columbia, S.C. Model 75A (shown) is one of a complete line of tractor shovels built by The Construction Machinery Division of Clark Equipment Co., in Benton Harbor, Mich. All are designed to deliver full capacity, full time. So naturally, Clark specifies dependable Bundyweld Tubing for vital hydraulic and fuel lines.

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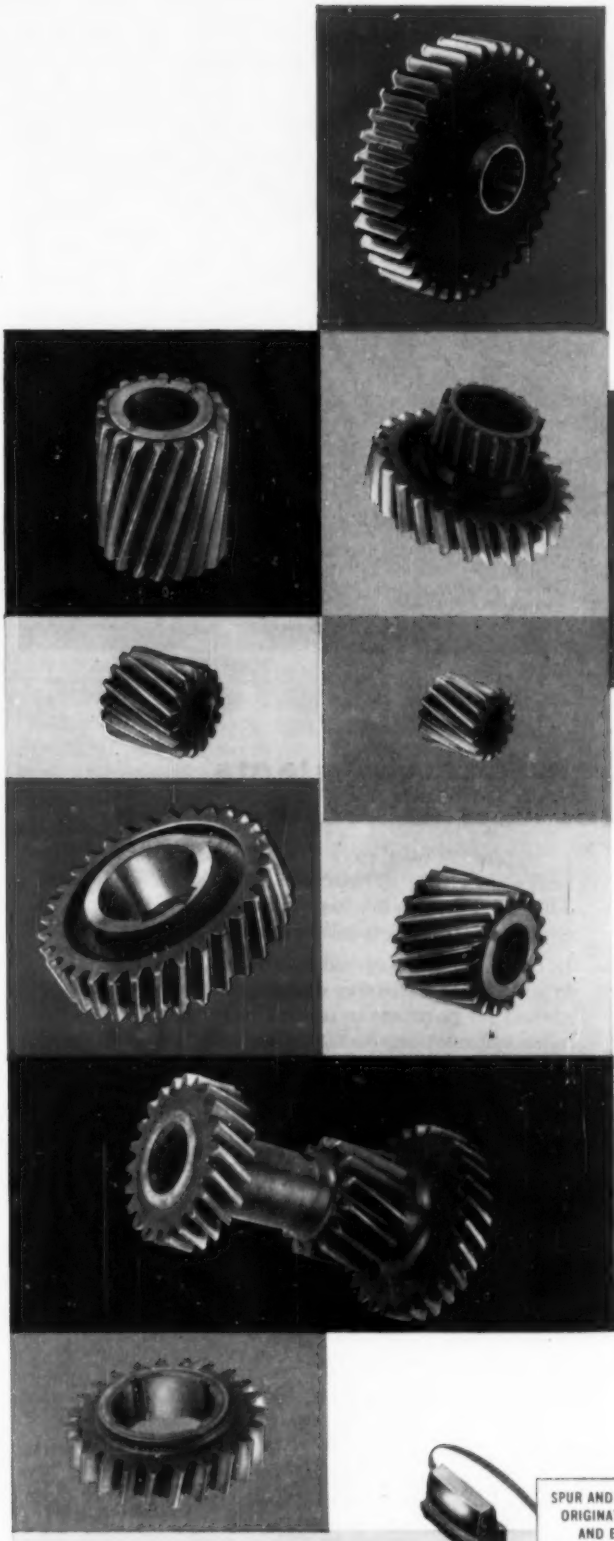

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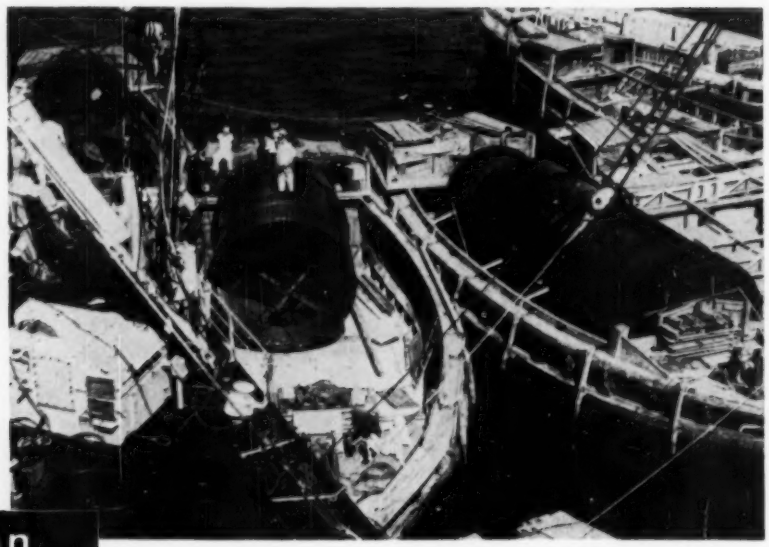

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Management Digest.

THE BEST FROM 68 BUSINESS MAGAZINES

FEBRUARY 1958
VOL. 13 NO. 2

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NEW YORK CITY
FEBRUARY 1958

Science and Supermen

It is becoming fashionable to think of the Russians as scientific supermen; technologically, they suddenly appear to be "nine feet tall." The sputniki are responsible for this thinking, and ever since their launching, Comrade Khrushchev (hardly nine feet tall himself) has been at pains to remind us of the "invincibility" of Soviet science.

We are very much impressed by recent Soviet achievements. They remind us that there is room for improvement of scientific education in many nations. Further, we could all emulate the Russians by placing our own teachers and scientists at the highest level of society, and rewarding them accordingly.

But it is a question whether (1) Soviet science is superior in and of itself, and (2) whether others should try to "catch up" by rushing headlong into all-or-nothing programs of scientific training.

The Soviets have the advantage of the totalitarian state in being able to focus all resources on a single project or aim, no matter what the cost in money or freedom. This fact, combined with the Russians' immense scientific ability, produced sputnik.

But this does not mean that other nations' scientists are backward. They are equally able, but they tend to work across a much broader spectrum of scientific endeavor.

Indeed, one of the most significant aspects of present Soviet technical education is its super-specialization. The aim is to turn out the most advanced technical man, in the narrowest fields, as quickly as possible.

It is not a question of being a mechanical, electrical, or chemical engineer—nor even a steel industry engineer. Rather the Soviets are producing an open-hearth engineer, an electric furnace engineer, a blast furnace engineer—intensely trained in his own field and nothing else. These technicians get no economics, little or no philosophy or history (but Russian) in their course of university study.

This system undoubtedly serves the Soviets well at the present time. But it would not serve all others—and certainly not those nations struggling to raise their living standards.

Such nations do not need super-specialists, they need more broadly-trained engineers and better-educated, non-engineering administrators. The manager, the man able to integrate and focus a company's (or a nation's) resources, is the catalyst of development.

R. V. Rao, Joint Director of Industries in the Indian state of Andhra Pradesh, puts the problem well. "It is harder," he says, "to provide all members of the community with a roof, shoes, and meat than to launch an artificial satellite."

Paul R. Miller, Jr.

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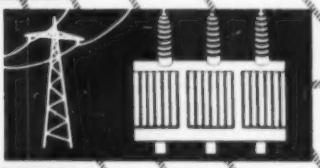

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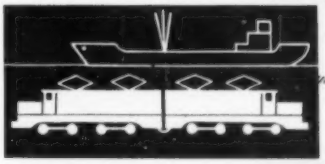

Electrical equipment for industry

Electronics
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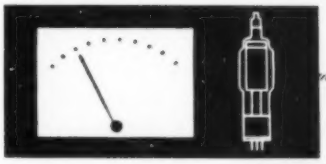

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▶ WORLD TRENDS

TECHNICAL ASSISTANCE IN 1958

There has been a lot of talk about multi-nation financial assistance programs lately—and you will be hearing more. But it is not quite true that such programs are in vogue.

The "Pella plan," for diverting European Marshall Plan loan repayments into a Middle East development fund, died stillborn. The much-publicized SUNFED plan (Special United Nations Fund for Economic Development) has foundered for the same reasons.

There are some formidable obstacles.

Only the U. S.—and possibly Germany—has the resources to make large-scale investments in less developed nations. And they show a great unwillingness to channel funds into multilateral schemes.

The U. S. Congress insists on keeping close check on aid expenditures—and the increased budget for defense limits funds available for aid.

National interests clash, inevitably, and fast action is hard to get. A $200-million fund for regional development in Asia, set up by U. S. three years ago, is now just beginning to be drawn on.

But you can expect to see increased attention paid to technical assistance—and to coordinating the complex and overlapping activities.

Technical assistance provides the vital groundwork (surveys, training, etc.) for later development, and improves prospects for solving political problems. That is why the U. S. A. recently agreed to double its contribution to the United Nations Expanded Program for Technical Assistance. And that is why there is renewed interest in the technical assistance potential of the Colombo Plan, Baghdad Pact, NATO, and the Organization of American States.

The U. S. will also encourage a bigger role for "third party" countries—Mexico, for instance, as a training center for Latin American technicians.

But the cry for development funds is too loud and insistent for the U. S.—and the free world—to ignore.

The Export-Import Bank will be strengthened, its lending authority raised from $5,000-million to $7,000-million. And there is a new U. S. Development Loan Fund earmarked for the "politically uncommitted" nations of Africa and Asia.

Competition with the USSR will color all plans for aiding the less developed countries in 1958. Russia makes much of the $1,800-million it has loaned. And Comrade Khrushchev will play his "Big Brother" role for the less developed countries at every opportunity.

TOO MANY PEOPLE?

Ignore population trends, and efforts toward economic development will come to nothing. This was the grim New Year's warning of a distinguished population economist.

Dr. Kingsley Davis, writing in the influential quarterly *Foreign Affairs*, states bluntly that the gap in wealth and power as between rich and poor nations is widening. Why? Because of the "astounding" rise in the rate of population growth, with poorer nations contributing far more than their share (MD, Oct. '57, p15).

No longer is population a guarantee of national strength; it can be a liability instead, says Davis. Advancing technology demands more highly

Turn the page for more WORLD TRENDS

trained men and women—yet many nations cannot train them at today's rate of population growth. Nor can they employ them—capitalization of long-term development projects is difficult in the face of rising consumption needs of new millions of people.

The only hope, says Davis, is limitation of births. He sees the day—not far off—when many nations will feel they must try to overcome the effects of one government policy, mortality control, by another government policy—fertility control. And he cites Japan (where the birth rate has dropped 41% since 1955), Puerto Rico (down 13%), India, and now Communist China as four nations that are pioneering population control.

EYES ON EUROMARKET

"Euromarket" now exists—on paper at least. But it will be some time before the six Common Market nations, and their trading partners, notice the difference.

The six will not start cutting tariffs among themselves this year. They are supposed to cut 25% between 1959-1962, and not until 1971 at the earliest are all tariffs to be eliminated. Nor does the timetable call for a common tariff for outsiders until 1971—though that may come earlier.

Meanwhile, outsiders try to "get ready" for the new Europe:

—U. S. businessmen seem more afraid they will be "shut out" by the common tariff wall. The almost universal reaction is "get into Europe before it is all sewed up"—via licenses, branch plants, partnerships.

—Raw material and food suppliers are mildly encouraged by a new United Nations study. The findings: Euromarket will not, in the forseeable future, cause major changes in grain, beef, citrus, fats and oils, cotton trade patterns. Some immediate changes are likely in cocoa (favoring European territories at the expense of Ghana, Nigeria, Brazil), and in tobacco (a much higher duty on quality leaf).

—Latin Americans hope for closer ties to Europe. They want to build up multilateral payments arrangements; they will try to attract more European investment; they are talking about greater political cooperation —in the U. N., or through the North Atlantic Treaty Organization.

THE MARCH OF BUSINESS

Watch this trend: The merged U. S. labor federation (AFL-CIO) has voted $1-million for overseas organizing. One likely project: to help the International Federation of Petroleum Workers form a world-wide union in the oil, chemical, and atomic fields, embracing 1-million workers in Europe, Latin America, and the U. S. A.

Speaking of atoms: Britain's "Calder-Hall" gas-cooled power reactor continues to influence foreign buyers. The first export order for the Calder Hall-type reactor is from Italy; now Germany and Japan are planning to follow suit. . . . Two U. S. manufacturers have joined hands with German firms in nuclear development: Westinghouse Electric Corp. will license the Siemens organization, and the Atomics International division of North American Aviation will work with Demag, AG.

Drive-It-Yourself: The organization of Hertz-American Express International Ltd. is the signal for an aggressive campaign to build a world auto-truck rental empire. The new firm will buy into existing Hertz licensees, establish new ones, and promote "drive-yourself" by providing management help, sales promotion, and advertising on a global scale.

No more pirating: Tokyo will strengthen its laws against the pirating of foreign designs by Japanese manufacturers. The provisions: Only original designs can be copyrighted; copies of designs appearing in foreign publications will be barred; violators must pay compensation.

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Payload capacities are up to an all-time high. Chassis construction features the elimination of excess weight while *actually increasing* strength.

As an extra bonus, Chrysler Corporation trucks give fleet owners new prestige styling that features smart dual headlights, massive new grilles and luxury cabs.

All in all, you would be well advised to check into the new Chrysler Corporation line-up of trucks for 1958. You will find they offer every advantage you want for efficient, economical fleet operations.

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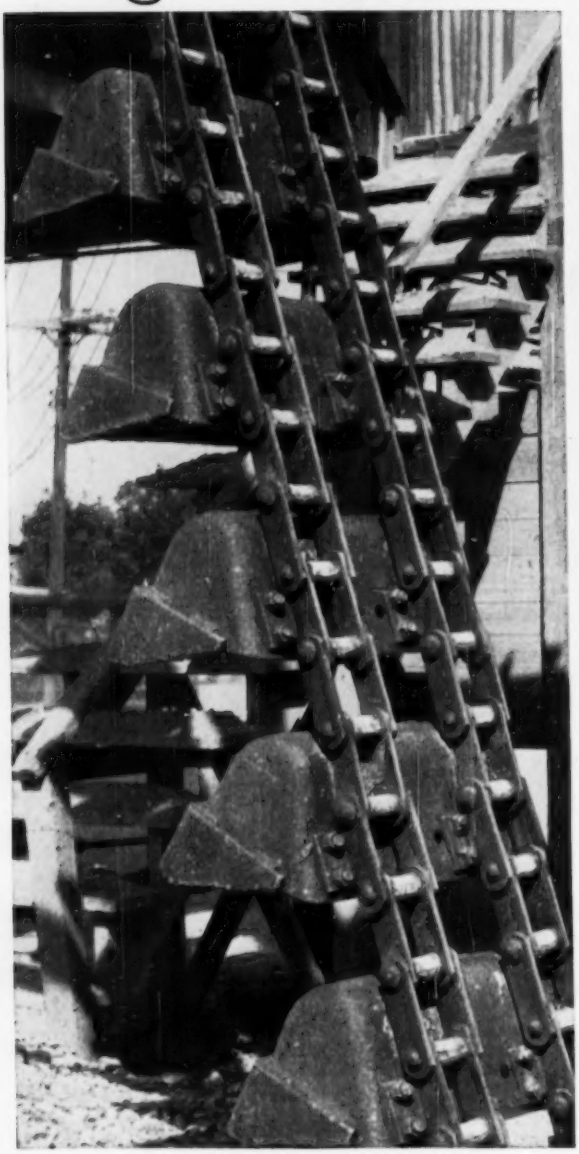
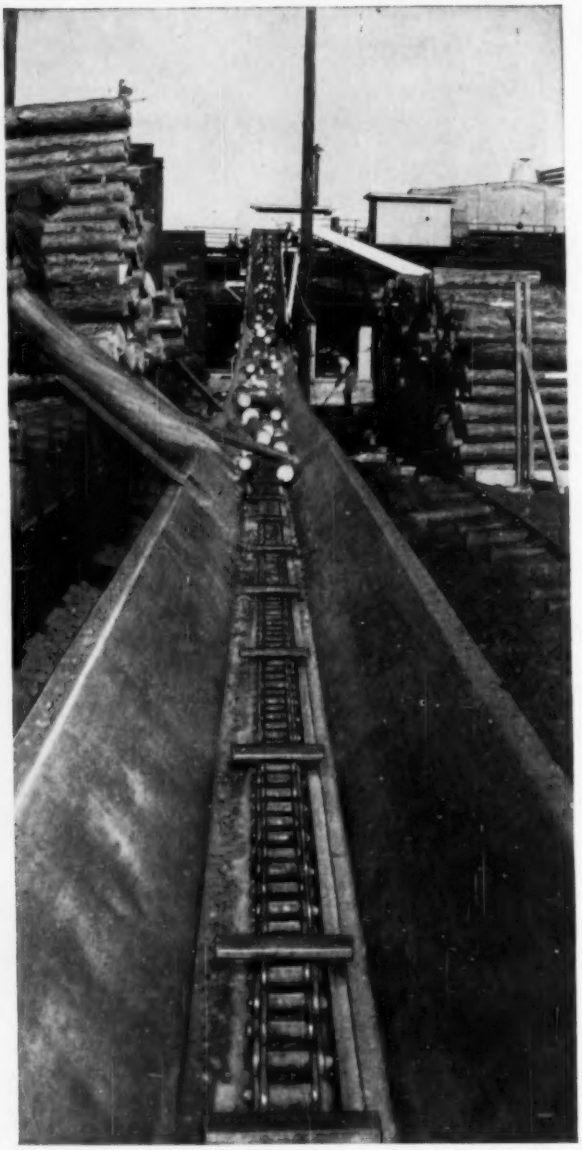


CARRIED 375,000 TONS OF STONE. Long past the life of previous chain (60,000 tons), Link-Belt Class SS bushed chain is still good for a long stretch of service.



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Iraq—Trying to Escape a Primitive Past

ECONOMIC DEVELOPMENT is a magic phrase. This year, the clamor for new, expanded development programs is echoing louder. At the same time, existing projects are facing new problems. Anywhere you look—Africa, Asia, Latin America—both the needs and the problems grow larger.

The Middle East is no exception. But there, the spotlight of world politics gives special urgency to the development issue. It is a safe prediction that many new schemes and projects for Middle East development will be debated in 1958 (page 7). It is also safe to say that the debaters will do well to study the experience of Iraq.

They can learn from Iraq's seven-year effort to make its "deserts bloom." The program is far from perfect; it, too, faces severe difficulties. Yet Iraq has one of the most complete programs in the world, and—most important—the Iraqis have shown a determination to learn from their mistakes.

To gain a clearer picture of how Iraq is doing, McGraw-Hill sent the Editor of *Engineering News-Record* to the Middle East to see for himself. What follows is a brief review of his report.

I. A Modern Mesopotamia

From the upland north to the flat, alluvial south, the half of Iraq that is not useless wasteland is dotted with construction projects. A few are finished, many more are just beginning. And back in Baghdad, there are enough new schemes to keep engineers busy for decades.

All this is happening because almost three-quarters of Iraq's government revenues and a comparable amount of its national energy are being devoted to one goal—that of giving the five-million people of Mesopotamia as near a 20th-Century living standard as possible.

Iraq has important assets to build on: Petroleum revenues help pay most of the bills; enough water; land—with not too many people to occupy it. Most important, Iraq has a government disposed to use its funds wisely. While one group of Iraqi officials engages in diplomatic war with Syria, Egypt, or Comrade Khrushchev, another arm of government—the Iraq Development Board—can devote its attention to the country's physical improvement.

The development board has its own income, protected by law, and power to run its affairs.

The board's first five-year program began in 1950; by 1955 it had spent $250-million completing two major flood control projects on the Tigris and Euphrates rivers. These set the stage for the much broader second phase, now under way.

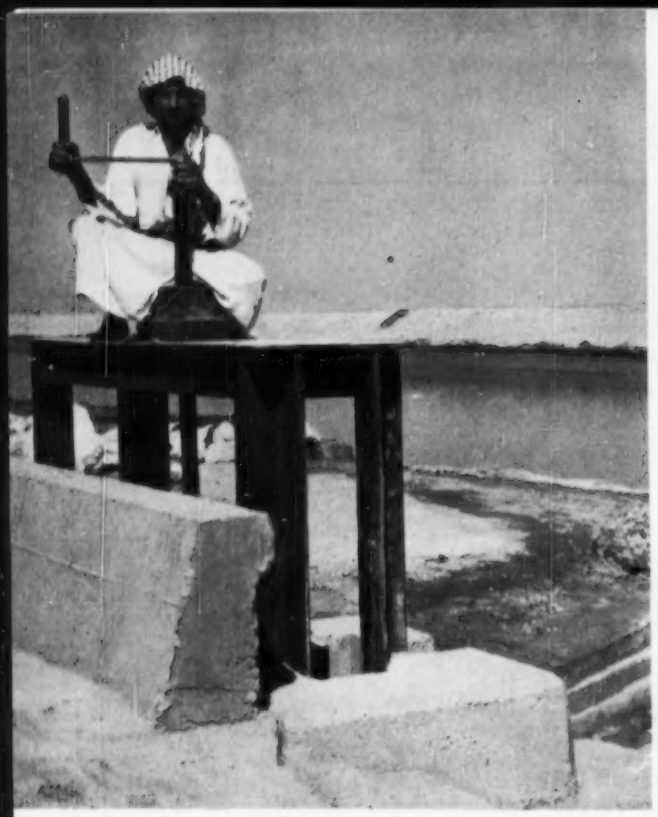
For the 1956-1961 period, $1,400-million was budgeted for development, with hopes that oil revenues might pay for 80%. But the cost of the Suez crisis was dear, and now Baghdad estimates that money will be available for only 65% of the budgeted program.

For a nation whose prewar budget was less than $30-million yearly, even $900-million in six years is a large sum for development. But when a nation's needs are as huge as Iraq's, almost any amount of money could be committed to desirable schemes.

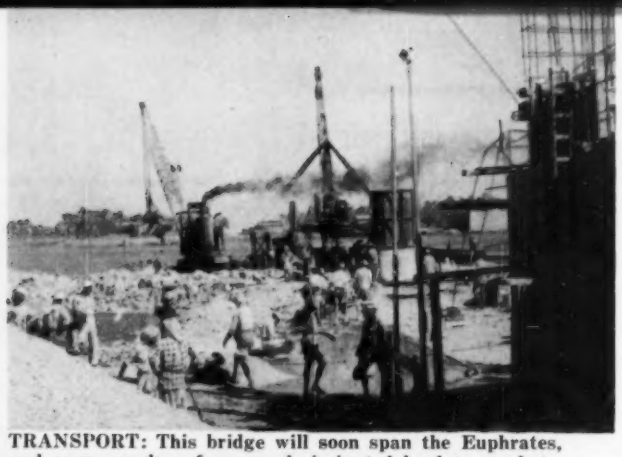
But no nation can absorb, let alone pay for, unlimited new investment. So Iraq's problem is one of selection: How many new dams, roads, houses, factories?

Whether the Iraq Development Board's individual selections have always been the wisest possible can be argued—and frequently is, by Iraqis themselves. Whether the planning and construction are always efficient is not arguable—Iraqis admit they are not. Yet compared with the chances for misdirection and failure, the Iraq development program moves forward much more than it stumbles.

Iraq insisted at the start on separating the development function from ordinary operations of government. The development board should be able to budget its funds



WATER: The gate tender symbolizes Iraq's challenge: to tame the great rivers, and channel water onto new land.



TRANSPORT: This bridge will soon span the Euphrates, and carry produce from newly-irrigated land to markets.

AGRICULTURE: New grain silos, rising next to an ancient caravansery, help northern farmers store and sell wheat.

with a minimum of interference.

That such a plan (which obviously deprived some officials of powers that they cherished) could be adopted is largely due to one man, Nuri as-Said, who resigned last year after 13 terms as Prime Minister. He convinced the leaders of Iraq that they should create the board; he organized it in 1950, charted its course, and pushed through the laws which assigned to its use 70% of Iraqi oil earnings.

While overall policy is set by the board, project planning, design, and administration is entrusted to a staff divided into five technical sections — irrigation and drainage; roads, bridges, public buildings; industries and power; agriculture; housing. Each section works up projects, studies their feasibility, passes the results on to the development board. If there is a favorable decision, the technical section and its consultants set to work.

The Iraq Development Board relies heavily on foreign advice. The overall program itself was set forth by Lord Salter of Britain. Two of the present executive members of the board are foreigners (an American and a Briton). The irrigation section is headed by an American, industries by a Frenchman, housing by a Greek. Wide use is made of overseas consultants, and all major construction jobs have gone to foreign contractors—

II. Water Comes First

Simply stated, the development board's job is to mold Iraq in a pattern where agriculture is the main-stay and industry, based on local crops and materials, provides supplemental employment.

At the start, Iraq and its foreign advisers agreed: Everything depends on water—the control of the Tigris and the Euphrates.

Iraq has not been diverted from concentration on water, even though some of its other needs have required attention too. Nearly a third of the 1956-1961 budget is going into flood control and irrigation. It seems doubtful that Iraq has the capacity for any heavier concentration on water, or for politically resisting demands for other types of spending.

The first job was flood control on the rivers, and two large systems have been completed. Now the great reclamation effort is in the alluvial plain between the two rivers, and further south amid the great marshes. Here is where the fable Garden of Eden once may have been, here is where the decisive battle to recreate a prosperous agricultural economy must be waged. Unless it is won before the nation's petroleum runs dry, Iraq will not have much use for other facilities it is building.

Roads get second place on the priority list: Farm output must be moved promptly to market, and the new industries' products and raw materials must be distributed.

The development board made a substantial beginning on road-building several years ago. But because of out-of-date specifications, some of the new roads failed under the first heavy traffic. Now, higher strength is being built into the roads, and the plan calls for 1,900 km. of highway by 1961.

Housing needs are every bit as formidable as water and roads, and they are rapidly becoming more pressing politically. Promised something much better than the mud and straw huts of the past, the Iraqi people are becoming impatient for more visible signs of

progress. The task is difficult becaus the need is so great, so widely dispersed.

There is a scarcity of building materials and skilled labor. Nevertheless, a program for 25,000 houses is under way, and should soon begin to bear fruit. The board has great hopes for experimentation with different designs and materials for housing.

Industry: Iraq can be a farm-surplus nation, through prcbably not to the extent that it c: finance all its needs from farm goods. But the board believes there is no reason why Iraq should buy abroad the things it can make.

The oil industry was a natural starting point—so an asphalt plant and an oil refinery have been set up. Next on the list were two cement plants. A new textile mill will reduce imports of cloth, and a fertilizer plant will use local natural gas. Liquid sugar from dates is the basis of another factory, and reeds from the southern marshes are under consideration for papermaking. To supply power to this small industrial complex, the board built three plants based on natural gas. To bolster agriculture grain and tobacco storage facilities are building.

As Iraq begins to move into the broad construction stages of its development, new problems appear, and the time for solving existing problems grows shorter. Planning, financing, and building facilities is difficult enough; then there are equally difficult problems waiting when the facilities are finished. Perhaps the greatest of these is the need to train Iraqis to manage the nation's new physical plant. And too, there is the knotty task of resettling population on irrigated lands, and teaching the farmers how best to use their newly won resources.

This is what makes the development board's job so much more demanding: Coordinating construction today with operations tomorrow. Fortunately, there is growing awareness of the magnitude of the problem. Barring political or economic catastrophe in the Middle East or in Iraq, the chances for success are bright. ●

Digested from Enginering News-Record, Dec. 12, p31.

Bidding for Business

Construction becomes more competitive as builders everywhere vie for profitable projects.

FEW BUSINESSES are as exciting as international construction. And few have become so competitive, with European, Asian, U.S.A., and Latin American contractors fiercely bidding against each other for the right to build the world's new dams, roads, and factories.

In almost every nation, business and government leaders this year are looking more closely at their construction plans (MD, Jan., p53). They are shopping for bargains, cutting costs, and—occasionally—postponing non-essential projects. To get the business, international construction companies are adapting new techniques, new combinations.

A vivid picture of construction competition has emerged from a recent survey by *Engineering News-Record* of 50 major construction firms doing a world-wide business. The survey revealed that while U.S. contractors are still getting a large share of foreign awards, others—especially Europeans—are starting to reap a harvest of business in areas once dominated by the Americans.

During the years following World War II, European construction men were busy rebuilding their own nations. Americans dominated the international field, built up a world construction business of something between $750-million to $1,000-million yearly.

This is being challenged now as never before. German, French, Italian, and British firms are the chief competitors; and lately, strong construction combinations from Denmark, Belgium, Sweden, Japan, and the Netherlands are appearing on the scene.

German firms have come up fast. In 1956, they had an estimated $170-million worth of construction under way overseas. Now their current backlog is estimated between $250-million and $500-million, much of it in South Asia, the Middle East, Latin America. French firms are winning new major contracts, and Italians have work-in-progress of more than $160-million. British firms—most active in Commonwealth lands and the Middle East—have work valued at upwards of $250-million.

Meanwhile, local contractors (in Latin America especially) are becoming a new source of competition for the European and American construction firms.

Capital investment in construction machinery by Latin American governments and individuals grows larger each year. This has stimulated development of large contractors, who have been apt pupils of the foreigners. Not only are they taking on large jobs at home, but have gained enough experience and aggressiveness to seek jobs in neighboring countries.

The major competitive advantage of European builders has been financial. Their costs are lower, and often they receive financial assistance from their governments. There is also the trend toward large consortiums, including banking interests who help finance a foreign project.

Even though American firms have had aid payments and Export-Import Bank loans to help them sell their services, they find the competition stiffening. So the majority of them are reducing their profit margins, making much greater sales efforts. They are agreeing to longer terms, accepting local currencies in payment. They are also making more extensive use of foreign materials, equipment, and subcontractors.

Finally, the competitive situation is encouraging joint ventures among international construction firms. A European and an American will team up, a move that may reduce the profit of each but at the same time cuts risks and improves chances of obtaining contracts.

In some Latin American countries, a strong nationalist spirit demands an alliance with a local contractor. The foreign company will provide technical help, some materials and equipment; the local firm has the labor, local materials, and essential local contacts. ●

Nestle Strengthens Its Outposts

The giant Swiss food producer pushes on with its expansion throughout the world.

Digested from BUSINESS WEEK, Dec. 21, p68

SWITZERLAND'S Nestle Alimentana has entered the year 1958 secure in its conviction that the world's growing appetite can only mean larger markets for its products.

And Nestle is ready to back its conviction with money. At a time when many manufacturers are cutting back investment plans, Nestle is putting $60-million into new factories and offices around the world. Even for a company as large as Nestle (annual sales over $1,200-million), this is a substantial expansion, and it is being financed entirely out of retained earnings.

As a food producer, Nestle ranks fourth in the world, and the largest outside the U. S. A. The company accounts for over 10% of the chocolate consumed, receives most of its milk from herds of 1.5-million cattle, and is the world's largest producer of soluble coffee.

Among manufacturers of all kinds outside the U. S. A., Nestle ranks sixth. The company has 130 plants, employs about 56,000 persons. The entire organization is administered in three large divisions—Western Europe, with 28,000 employees; the Sterling Area, with 13,000; Western Hemisphere and the Pacific with 15,000.

Managing this enormous organization is Dr. Carl Julius Abegg (cover picture), 67 years old and Switzerland's leading businessman. Though president and chairman of Nestle, Abegg finds time to be a writer, philosopher, composer (an Abegg oratorio was performed at Bayreuth), bank and insurance company director, and head of one of Switzerland's richest families. The Abeggs are the largest single holder of Nestle stock, which is considered a prize "blue-chip" investment in European markets.

Abegg is also a manager. He gets much of the credit for the fact that Nestle sales have expanded sixfold since 1939.

Two developments at Nestle have contributed to this growth. Soon after he became chairman in 1948, Abegg arranged a merger with Maggi of Switzerland, a food processor doing a $100-million-a-year business in Europe. Secondly, Nestle launched a world-wide campaign to popularize Nescafe, the soluble coffee developed in the company's laboratories just before World War II.

NESTLES Abegg, 67, is a part-time writer, poet, composer, insurance man.

That research has paid off handsomely. Today Nescafe is Nestle's biggest sales item in the U. S. A., a market where "instant" coffee now accounts for 30% of consumption. And Nestle is pouring new money into expanded production and marketing. Last year, for example, Nestle U. S. A. placed a single $200,000 advertisement in a national magazine to sell Nescafe.

Nescafe is blended differently for each market, be it the U. S., a European, Latin American, or Commonwealth country. Americans can choose from four versions (weak, strong, with chicory, without caffein); even coffee producers such as Colombia or Brazil have their own Nescafe. In many areas, Nescafe enjoys a near-monopoly, despite intense competition that has developed in the past decade.

In addition to Nescafe, Nestle makes an "instant" tea, and "instant" chocolate milk and a cocoa, bouillons, sauces, dehydrated soups, protein foods, condensed and powdered milks, chocolate candy.

The company is an important customer for businessmen and

farmers throughout the world. Nestle is one of the major buyers of green coffee and cocoa beans in Latin America and Africa; it consumes huge quantities of seeds and vegetables—to say nothing of milk. In a recent year, Nestle plants bought more than 167-million liters of fresh milk in each of three Western European nations.

The company is increasing milk production in Latin America by flying in cattle, and encouraging local dairying. It has done much the same thing in Europe for many years, always adding modern touches. For example, polyethylene pipe lines deliver milk from cows who spend the summer high in the Alps.

The present Nestle expansion program is world-wide: Everywhere you look the company is building new facilities, expanding old ones, and installing new machinery.

The U. S. company is getting a new $4-million headquarters, a California Nescafe plant is building an addition, and Maggi products are set for a major marketing offensive. In Cuba, a new Nestle container factory is building (the company makes almost all its own cans and containers); West Germany, Norway, and Italy have newly-expanded condensed milk plants. New equipment is going into France, while Britain and Holland will have a new plant space for Maggi products. Canada and Brazil are adding powdered milk capacity.

All this is a long step from Henri Nestle's business beginning in Switzerland 90 years ago. He had hit upon a formula for a special milk food for babies; that led soon to the chocolate industry and through merger, aggressive production and marketing, Nestle had become an important world supplier by the early 1900s. By the late 1930s, Nestle had 93 factories on five continents. In 1956, the company reported net profits of $10-million, and assets—very conservatively stated—of $90-million.

Ever since he was a youth working in family textile mills (in Russia, Bulgaria, Turkey, Italy), Abegg has been involved in international enterprises. His present insurance and banking connections have important international ramifications. And he has an honorary doctorate from Zurich University for his leadership in expanding Swiss foreign trade.

Not surprisingly, Abegg's views on trade carry a lot of weight in Switzerland. Today, he is one of the strong Swiss advocates of economic integration. Abegg favors the European Common Market, and believes Switzerland should join a Free Trade Area associated with it. Integration, says Abegg, is an essential step toward higher living standards. And with higher living standards, he naturally expects higher consumption of Nestle products. ●

Born in Europe, Bred in U.S.A.

American manufacturers are looking around the world for new product ideas.

By 1960, at least 10% of the manufactured goods sold in the U. S. A. will be in products that today do not exist.

This estimate (and recent experience suggests it is sound) is a measure of the increasing American emphasis on product research and development. All the surveys of manufacturers' plans for 1958 reveal that investment in new product development will continue the dramatic rise of the past five years, even though capital spending for new plant capacity and equipment is expected to fall off.

To be sure, some of the ideas for 1960's products already exist. And more American manufacturers are looking for them outside the U. S. A.—in Europe especially, but also in other areas.

Here is how the Americans are going about their product search:

The Armour Research Foundation of the Illinois Institute of Technology has enrolled 20 companies in its "European Technical Observation Group," now just 18 months old. A team of five Armour engineers (based in The Hague, Netherlands) combs Europe for product ideas in the fields of mechanical, chemical, and electrical engineering, and in chemistry and metallurgy.

Already these foreign observers have helped the Armour clients arrange exchanges of information and of products with European firms, and have turned up information on basic research trends that may lead to new products.

Stanford Research Institute (MD, June '57, p20), operating on its own, has recently opened an office in Zurich, Switzerland, to watch for ideas in electronics, chemistry, heavy industrial lines. The findings are funneled back to a dozen SRI client companies.

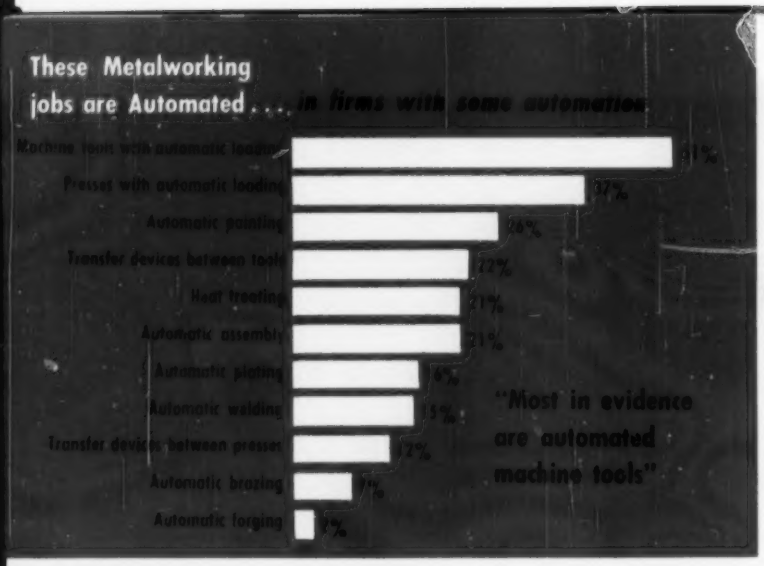
The flight of American investment, and its accompanying technology, around the world since World War II sometimes obscures the two-way nature of research and development. Overseas plants of U. S. companies are producing the parent's product tailored to foreign needs. In the process, new ideas frequently turn up.

Thus, overseas subsidiaries of American manufacturers act more and more as sentinels to watch for product ideas. Many of these foreign subsidiaries have their own engineering departments, and there is a lively exchange of research data and design work between subsidiary and U. S. parent.

Dr. H. J. Rand, an American scientist who heads his own research and development firm, says most product ideas are bred in the U. S. A.—but born in Europe. He cites the example of automation:

"The U. S. A. is ahead in machine tools because we have progressed further into automation. Our high labor costs are responsible for that. However, the theory and basic ideas of servomechanisms and automation came from Europe."

Rand believes that many American companies owe their success to the manufacture of products on a license arrangement with a foreign company. He suggests that U. S. manufacturers interested in ideas from abroad employ technical representatives native to the countries in question to scout for product trends. (*Product Engineering, Dec. 2, p21*) ●



● REPORT TO MANAGEMENT

1. Automation is blazing new trails in U. S. metalworking, a new survey reveals.
2. A look at other industries—food, chemicals, textiles—shows an equally sharp impact.
3. But beware of the dangers inherent in investing in special automatic equipment.

Another Look at Automation

"In its most complete form automation is the almost total replacement of human labor—physical effort, observation, memory and decision—by mechanical processes in a prearranged program."

Those were the words of Belgium's Minister of Labor, Leon Troclet, speaking at the automation debate sponsored by the International Labor Organization in Geneva. The ILO met to discuss the social impact of automation, but the 160 speakers analyzed all aspects of the technical revolution that is transforming industry everywhere.

Two basic conclusions came out of the ILO debate. The first is that automation is here to stay, a fact that has been finally recognized by responsible labor leaders, as well as business men, scientists, and engineers.

The other is that automation is not an all-or-nothing affair. Rarely do you find the complete form of automation described by M. Troclet, but partial automation exists wherever you look, even though it may not go by that name. It is the handmaiden of technical changes in all phases of industry, transport and office procedures.

In this broad sense, where does automation stand today? Where is it headed? To what extent is it helping small as well as large business firms? What are its limitations, its dangers?

Some of the answers to these questions come out of a survey of the U. S. metalworking industry recently conducted by *American Machinist*, the McGraw-Hill magazine that nine years ago first used the word "automation" in print, after it had been coined some months earlier by D. S. Harder of U. S. A.'s Ford Motor Co. Other answers are evident from the novel automatic set-ups described on the next two pages; and some of the qualifying aspects that go into answering these questions are given in an analysis by the *Harvard Business Review* of the special pitfalls of automatic equipment.

1. Impact on Metalworking

The *American Machinist* addressed itself to companies representing (in terms of employees) 10% of America's metalworking industry. Questions like these were asked: How much of your plant is automated? What processes? Why did you go to automation, how was it planned? How soon does automated equipment pay for itself? Can automation be flexible?

The survey showed that four out of five metalworkers are employed in plants that have some degree of automation. But it is the larger firm that leads in the changeover: only 19% of the companies surveyed use automation, but they employ four-fifths of the workers.

How much automation is used varies widely between segments of the industry. Makers of office machinery lead, with 46% of companies automated. The auto and electrical industries tie for second with 34%. In tenth place are aircraft manufacturers, with 11%; and not a part of the first ten are the makers of automatic devices themselves—less than 1% of these companies have found it feasible to adopt a significant amount of automation.

What form automation takes in the metalworking industry can be seen in the chart above. Most in evidence are machine tools with automatic loading and unloading features. Less than half of the companies that use them appear to have gone to automatic transfer devices between these tools, which is the next logical step in automated metalworking.

About 37% of automated metalworking plants have presses with automatic loading and unloading. The heaviest concentration of such presses is found among makers of precision mechanisms. Office machinery is second and electrical equipment third. Only 12% of au-

Great Britain's industrial and trading success depends upon the vision and energy of businessmen like Michael Stokes of Burroughs

A man essential to a great trading nation

LONG before the advent of steam, British merchant ships sailed throughout the world to establish Great Britain as the world's leading trading nation.

Today, international trade is still the backbone of the British economy. In 1956 her exports exceeded £3 billion.

To meet growing trade competition, British businessmen have been constantly improving business methods. Burroughs men, such as Michael Stokes, are providing them with the advanced business systems and machines that sharpen efficiency and bolster profits.

Michael Stokes worked for a large department store chain until the Second World War when he served as a Royal Air Force officer. At the war's end he became the manager of a building contractors' firm in Leicestershire.

Stokes joined Burroughs' Nottingham Branch in 1950 as a sales trainee. He is now a Zone Sales Manager in Liverpool, the largest port in Great Britain. His clients include many export and import houses, as well as a wide range of domestic firms.

Businessmen the world over look to Burroughs men, like Michael Stokes, for the methods and machines to keep pace with today's economy. They offer the most advanced and complete line of business machines available.

Call your local Burroughs man and let his knowledge and experience help solve your business problems. For his address, write to International Division, Burroughs Corp., Detroit 32, Michigan, U.S.A.

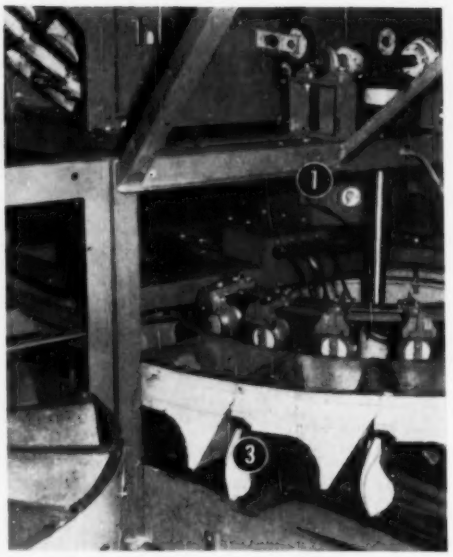
tomated companies use transfer devices between presses.

A surprising number of metalworking firms have turned to automatic painting. It is becoming common practice among makers of office machines as well as auto manufacturers. Other process operations that have been automated in many plants include heat-treating, plating, and welding. But only a small number of plants have as yet seen their way clear to automation of such operations as brazing and forging.

Automatic assembly was reported by a fifth of the companies with some form of automation. Details of the survey indicated that only the largest firms had turned to this advanced form of automation.

Other revelations of the survey: Many firms today say they have turned to automation in order to improve the quality of their product, rather than just to reduce labor costs and increase output. Often, there has been no important displacement of workers, but rather a rise in production and an upgrading of labor. Larger staffs of skilled maintenance, tool, and engineering personnel have been put to work in place of unskilled and semi-skilled operators.

About 94% of the firms reported that automation had lived up to their expectations—after initial difficulties. Large companies expected their automation to pay for itself in three years; the medium-sized (100-999 men) hoped for a major write-off in two years; while the smallest firms (1-49 men) found they had to spread a substantial part of the cost over a period of more than three years. The importance of building flexibility into an automated unit—as insurance against changes in the product—was emphasized, even though such flexibility might add 20% to initial cost.



SORTING: Lemons, scanned by viewer (1), fall to holes of distributor wheel (2) . . .

2. Automation Put to Use

Though the metalworking industry coined the term, it shares the impact of automation with a broad range of businesses. To many business and technical men, automation means no more than advanced mechanization. Others say there is a big difference—that mechanization is the substitution of machines for man's muscles and energy; automation is the further substitution for man's senses and memory.

What has happened is that automation, in whole or in part, has swept into every phase of the industrial world. Automation means efficiency, and as such, it is widening its scope at a relentless pace. Its impact on small firms means such things as innovations in materials handling (MD, Aug. '57, p65), and low-priced wonder-working office machines (MD, Dec. '57, p55). For large firms, it has brought continuous foundry operations (MD, Jan. '58, p158) and nearly "man-less" chemical plants, oil refineries and bearing manufacture (MD, Nov. '57, p47). Some of the latest aids to various industries are described and pictured on these pages.

HANDLING, STORING: Some 60% to 90% of the cost of making steel goes into handling operations, according to the American Iron & Steel Institute. Other industries—food, chemicals, electrical appliances, paper and pulp—consist largely of moving the product from place to place. It is no wonder that automatic conveyors, distributors, controllers, have been welcomed by all industries.

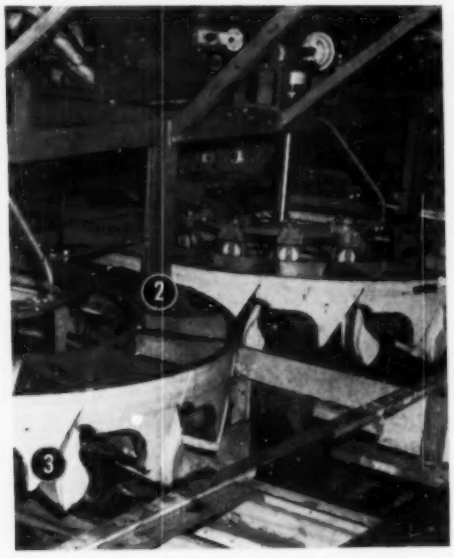
A prime example is the modern warehouse of H. J. Heinz Co. at Pittsburgh, U. S. A. Cases of food move about the plant via 17 automatically-controlled conveyors, 4 pallet-loading machines, and 33 fork trucks, all linked together in a unified handling system. A single operator controls the conveyors and pallet loaders; by pressing a button he selects a pattern for distributing cases from overhead trunk conveyors to one of the loaders. The 33 fork truck operators move pallet loads from conveyors to storage, storage to shipping docks, or conveyors to shipping docks.

Handling innovations at other American plants include remote routing of lift trucks (picture, right), automatic baling of scrap, automatic transfer of heavy appliances from roller conveyors to overhead carriers, and a mechanized warehouse where inflow and outflow are monitored by an electronic computer.

FORMING, ASSEMBLING: Automation of machines that form and shape products has moved in two directions: special machines with built-in automated skills; and automatic attachments for standard machines. The second method gives more flexibility to the manufacturer, and can be a road to the future step of automating the assembly of components into a finished product. Often this last involves intricate programming, positioning, timing.

Ingenious machines for cutting, punching, soldering, and welding now are in operation, automated in whole or in part. A unit developed by U. S. A.'s Clark Controller Co. solders a ratchet shaft into an overload relay tube. Cost was cut from 9 cents to 1 cent per assembly. The operator only inserts the shaft into the tube, then the machine dips the parts into a flux pot, turns the shaft, dips into a solder pot, rotates the shaft again, then washes, dries, cleans and ejects the assembly.

Screwdriving has been made automatic by another American firm, Pneuma-Serv, Inc. A unit in use by a metal fabricator delivers, sets, and drives 17 screws in an



. . . Memory device triggers trapdoor (3) as bucket passes over the correct conveyor.

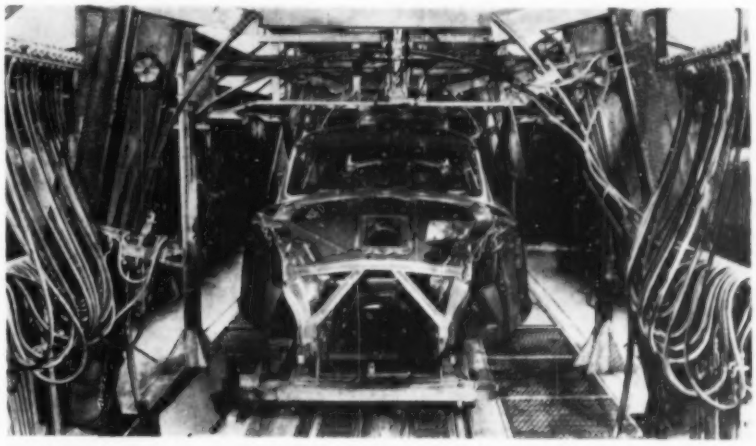
FORK TRUCK moves without an operator in a system designed by Barrett-Cravens Co. that routes the load by a wire imbedded in the warehouse floor.

irregularly shaped pattern at a rate of about one screw per second. Compressed air feeds the screws one at a time through a plastic hose. A special head on a power screwdriver grips them and drives them at the desired angle. When one screw has been driven, the next is fed and instantly positioned.

PROCESSING, FINISHING: Processing of chemicals, foods, and textiles have yielded readily to automation, as have such finishing operations as plating and painting. How chemical-plant automation works can be seen in the new calcium carbide and acetylene plant of National Carbide Co., U. S. A. Material flow centers upon two continuous-process revolving furnaces. Conveyors, mixers, and feedlines respond to automatic controls, so that trouble at one point shuts down related units. The acetylene generating facilities themselves are of continuous design, permitting direct pipe-line delivery of the final product.

Bakers also have turned to automation. An installation in Brooklyn, U. S. A., bakes trays of bread as they move by conveyor through a mechanized oven, then dumps the trays on another conveyor for transit to a cooler. Slicing and wrapping operations also are automatic.

INSPECTING, SORTING: Electronic devices have been put to work inspecting, sizing, gaging,



PAINT sprayed automatically means less paint for a given job at American Motors Corp. Switch triggers paint gun so that is sprays only as car passes.

KEY-PUNCH CARD goes on each case of Timken bearings, enabling a computer to control input, storage, and output at mechanized shipping center.

and sorting products. Included are isotope gages for controlling the coating thicknesses of paper and metal, infrared spectrometers for analyzing process streams. X-Ray level-checkers for sealed cans, and conveyor systems for magnetic inspection of metal parts.

A machine recently installed in California employs two photoelectric cells for sorting lemons by color. The system sorts the fruit into five grades—from ripe yellow to dark green—by actuating an electronic tripper that routes each lemon to its proper conveyor and packing station. The system is more accurate than hand sorting, and has released 40 fruit handlers for other kinds of work.

3. Investing in Equipment

Automation often demands large investments in special automatic equipment. Not all such investments have proved to be profitable for the companies involved. Some of the financial dangers are pointed out by *Harvard Business Review* in an article posing such questions as: How does the life expectancy of standard and custom-built machines compare? Is the problem of estimating different? Will actual cost be further above estimates for special equipment?

Studies show that special automatic equipment not only has a shorter service life but that any estimate of its life will have a wider margin of error than for standard equipment. One major reason is that automatic units can not be adapted as readily to design changes in the product being handled. Changes in the product's shape, size, and material often can be made only within narrow limits.

Adapting custom-built tools to product-design changes also is far more costly than for standard tools. The recently advanced "building block" approach—using standardized major elements combined with specialized components has proved valuable, but it can not always be applied. Even when applicable, savings are cut down by the need to carry used but unusable components in inventory.

Further, the trend is toward a shorter life for any one product design under the pressure of technological and marketing changes. Shorter product life means premature obsolescence for the special equipment designed to produce it, which has a critical effect on the expected return from automation.

Before investing in any automatic production machine, management should seek the collaboration of engineers and marketing men in a detailed study of the probable life of the unit. The company must give due consideration to possible changes in its product, and with this in mind, find some means of adjusting estimates to special risks involved.

Many firms make the mistake of estimating the cost of custom-designed automatic equipment in the same way they do for conventional equipment. They forget that added charges may be involved, including the time of designers, the project engineer, and supporting maintenance men and technicians. Special equipment normally requires a longer break-in period, involving the labor of skilled operators, machinists, electricians, and mechanics over an extended period.

Another factor to be taken into consideration: The shift to automation normally involves a decrease in in-process inventories but increases in the inventories of raw materials and finished goods. This has an important effect on costs. Also, don't forget to consider the cost of relocating or retooling existing equipment, and the eventual salvage value of both the equipment being installed and equipment being replaced.

Estimates are subject to far more error in dealing with special equipment than with conventional equipment. A manufacturer who installed several units of both in the last three years found that its actual outlays ran 38.2% over estimates for special equipment; for conventional units, with the same contingency allowance of 10%, actual outlays were 6.5% less than estimated. Other firms report the same average for automatic equipment, much of it attributable to added costs during the break-in period.

In view of the relatively short and uncertain life of special automatic equipment, these three safeguards are essential: 1) Estimates that are as precise as possible; 2) Adjustments in estimates to reflect the uncertainty involved; 3) Revision of the expected rate of return from automation—demanding earlier repayment as a hedge against equipment obsolescence. ●

Sources: American Machinist, Oct. 21, p 165; Factory Management & Maintenance, Nov., p 129; Harvard Business Review, Nov.-Dec., p 73.

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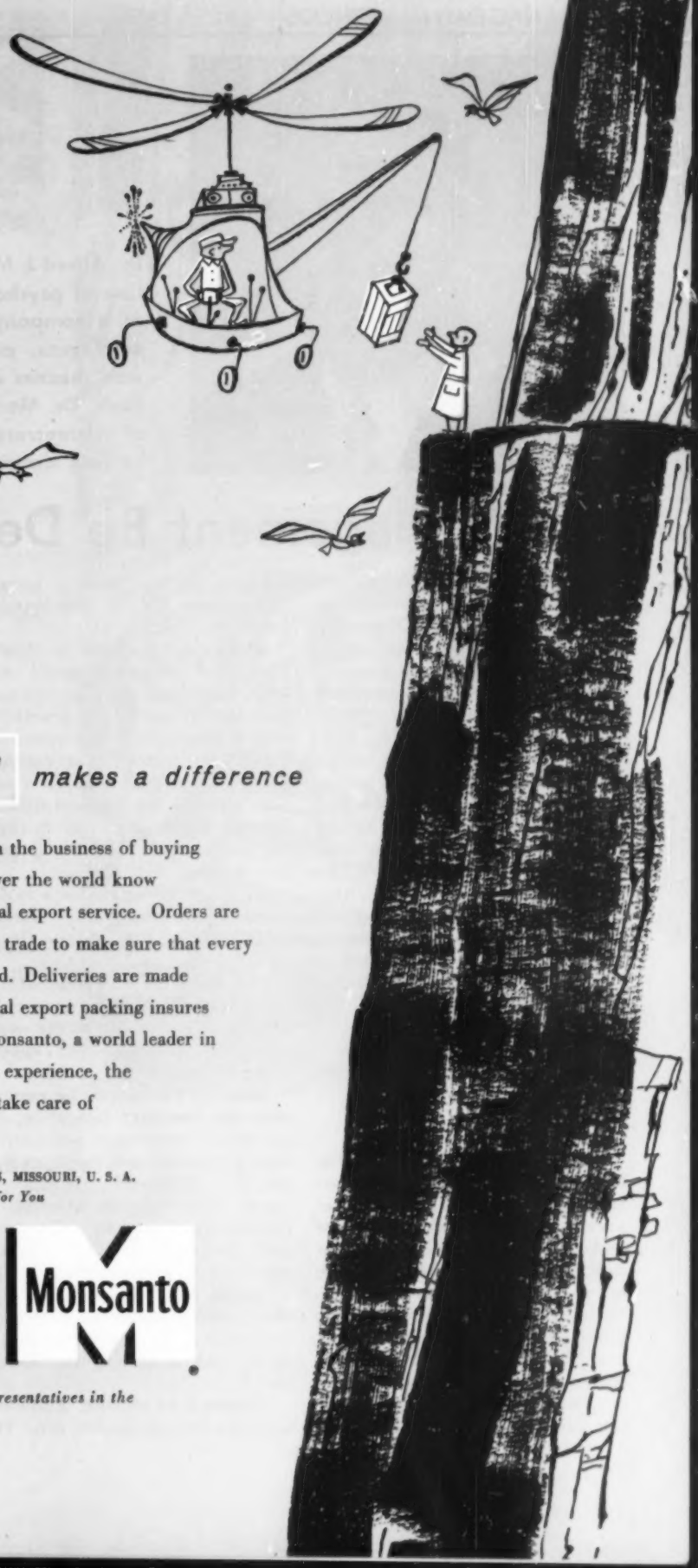
See also **Your Management Reading** on another page in this issue.



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Dr. Alfred J. Marrow (left) is a rare combination of psychologist-businessman: president of a company with five plants and 1200 employees, and a trained social scientist who teaches in his spare time. In a new book, Dr. Marrow lays down the principles of "democratic" management, and a challenging doctrine to managers everywhere.

Can Management Be Democratic?

"This may sound visionary and wholly impractical," warns Alfred J. Marrow, as he gives his definition of leadership. Marrow believes that leadership can be assumed by different persons at different times in the same group, that the situation determines leadership: "As psychology analyses it, true leadership is characterized not by domination, but by service."

Marrow is a manager who can speak for himself when he talks about psychology-in-business. He is a psychologist in business himself—a trained social scientist and president of a pajama manufacturing company (the U. S. A.'s Harwood Mfg. Co., with five plants and 1200 employees). And he has worked with some of the U. S. A.'s leading industrial psychologists in putting classroom theories to the test.

I. Motivation and Morale

Psychology—the science of human behavior—is becoming of central importance to industry: Capacity to produce depends more and more on the workers' motivation and morale. It is a question of motivating groups—not individuals. As Marrow puts it, "The group provides a form of control over the conditions of work that the individual has lost in our modern industrial environment." And the success of today's executive depends on "his skill in getting things done by, for, and through people."

Marrow's viewpoint is usually associated with professors who have made few, if any, business decisions. Since he is a practicing top executive, his conception of modern management deserves more than passing attention. In a new book (*Making Management Human*, McGraw-Hill Book Co., $5.00, 1957) Marrow presents his credo in pungent prose.

"If a worker feels that he is distrusted by management," Marrow exclaims, "he will distrust it in turn."

And from the viewpoint of the social scientist, industry's perennial conflicts can be traced to the worker's psychic hungers— and *l'appetit vient en mangeant.*

Many of the words he emphasizes are familiar: delegation, cooperation, confidence, permissiveness, group decision, participation. But Marrow breathes life into concepts that often lie dormant in psychology textbooks. On trust and confidence: "The 'trustee' system has worked well among criminals in prison; it is strange that business management has not borrowed a lead from the penologists book, in dealing with honest men."

Marrow is an idealist. And what concerns him the most is this: The average man on the job may not seem to have the capacity for leadership—he stubbornly resists change, he is small-minded about "status" and easily aroused to antagonism. But, contends Marrow, it is the frustrating conditions on the job that make him like this. Off the job, this same man conducts his life with intelligence and responsibility.

How can you get this man to act with the same responsibility and intelligence on the job? He will, says Marrow, in a company "where the boss does not instruct or command before he has consulted his fellow workers, and where the major problems confronting the company or department are freely and openly discussed; where plans for the future are disclosed early enough to enable all to see what lies ahead; where authority is delegated; where no one . . . is considered indispensable."

II. Not the Easy Way

That would be an ideal company. But Marrow doesn't contend that the democratic method is easy. Crises, in fact, put democratic leadership to such a severe test that some people doubt that it is adequate for crises. A crisis, he says, "calls for a leader who can transmit such a sense of urgency to his group that minds quickly meet, but heads do not knock to-

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gether"— a challenge indeed.

At the opposite pole from this ideal organization is the authoritarian company with a rigid organization structure. The aims of an authoritarian leader, says Marrow, "are personal to himself and express his private needs only." And the business controls he often imposes are "brakes on the intelligence, the honesty, and the responsibility of able men."

"Businessmen object loudly to too many government controls," he points out. "But the same businessmen tend to set up a profusion of similar controls in their own companies."

The paternalist too gets an equally sharp prick from Marrow's pen: "The most prolonged industrial conflicts and the bitterest antagonists seem to occur mostly in paternalistic firms. . . . The workers' demands are essentially symbols . . . of the . . . psychological dissatisfaction of men who have been treated as children."

III. Clear Implication

Treating a man as an adult, to Marrow, is treating him as a responsible member of his group. This is a basic theme, and his point of departure is that "No man is an island."

People join groups for deep and complex reasons; the simple explanation is usually that the group "fills a need." If a man genuinely feels that he "belongs," he is "inwardly at ease as well as outwardly accepted by his group." "Belonging" is signified by adherence to the code of the group—whether dress, speech, manners, diet, sports, ways of thought, life and culture. Groups have goals, standards, structures, and leadership.

Marrow takes issue with the social critics who extol the individualist and see group pressure as a destructive force. He sees no conflict between creativity and cooperation, between initiative and conformity. There may be individuals who are little concerned with group approval, but most adults have a strong habit of conforming to group pressures. This is a central fact of life, and always has been.

For the industrial manager, the implication is clear. As Marrow puts it: "Any attempt to change an individual worker from one pattern of behavior to another is apt to be futile unless it is worked through the group he feels he belongs to."

And Marrow gives specific examples from his own experience of how group pressures work.

IV. Group Pressures

A group of workers in a Harwood plant successfully challenged a new pay rate by holding down their output. Even after the rate was restudied and held correct, the group continued to restrict production. At last, however, the issue was brought to arbitration, and an upward adjustment of 11% was agreed on by representatives of management and the union.

Within six weeks, daily output jumped an average of 35%. Moreover, group output continued to rise; at the end of six months, the average daily level was 60% greater than before arbitration.

This group, Marrow comments, had a strong "we" feeling. And from such a feeling—which depends on the interdependence of members, not how alike they are—comes "a good-humored readiness to share chores and challenges and to reconcile personality clashes."

In a similar case of work restriction at Harwood, a group of workers quickly reached new levels of production after a series of departmental problem-solving meetings. One operator was absent during the departmental meetings —though present during the six weeks of restricted output—and for 10 days she continued to produce 40% less than other members of the work group. Soon, however, her production began to rise, as the group's pressure forced her to accept the new standard. During this period, nothing was said to her by the supervisor, except by way of encouragement.

Marrow sees such incidents as the results of group decisions. And the key to influencing group decisions is participation—"genuine participation." Workers should not be invited to decide anything unless the decision is really up to them. If it is not, they should be asked for "counsel, not consent."

Marrow and his associates have tested the participation approach by actual experiments with a production problem. They selected three groups with equal records. One group was given explanations without a discussion; the second group discussed the problem without setting specific goals; and the third discussed the problem and agreed on a goal toward which to work. Only the third group increased its production.

Agreement among a group of workers is not usually hard to get because of the desire to go along with the group. But Marrow warns that "discussion without decision leads to no action." And a group decision does not relieve a supervisor of his obligation "to carry out a policy, to implement it—to function, in fact, as an executive."

V. Key to Training

Participation is also the key to executive training. Marrow ridicules the current vogue for "banalities and bromides," glibly handed out.

"Verbal knowledge is not know-how," he warns. And "unless a man is jarred out of his customary way of perceiving people, he will not give up the beliefs and attitudes of a lifetime."

Marrow is an advocate of training methods that provide an opportunity for the trainee "to change himself"—the case study or workshop methods, discussion conferences and "role playing."

A "permissive" discussion often produces puzzlement and even resentment in a new trainee. But as the group discussion develops, the participant begins to ask himself questions he never asked himself before, and to feel self doubt. New insights often follow: A foreman might get a new perspective on some action he took a year ago.

Without seeing himself in action, a man may continue to be "sarcastic, threatening, inconsiderate, intimidating, or unclear without knowing it."

But before embarking on such a training program, remember these words of Marrow's: "A democratic middle management cannot live under authoritarian top management."

Management must be prepared to pay for participation, "in time, authority, and prerogatives." ●

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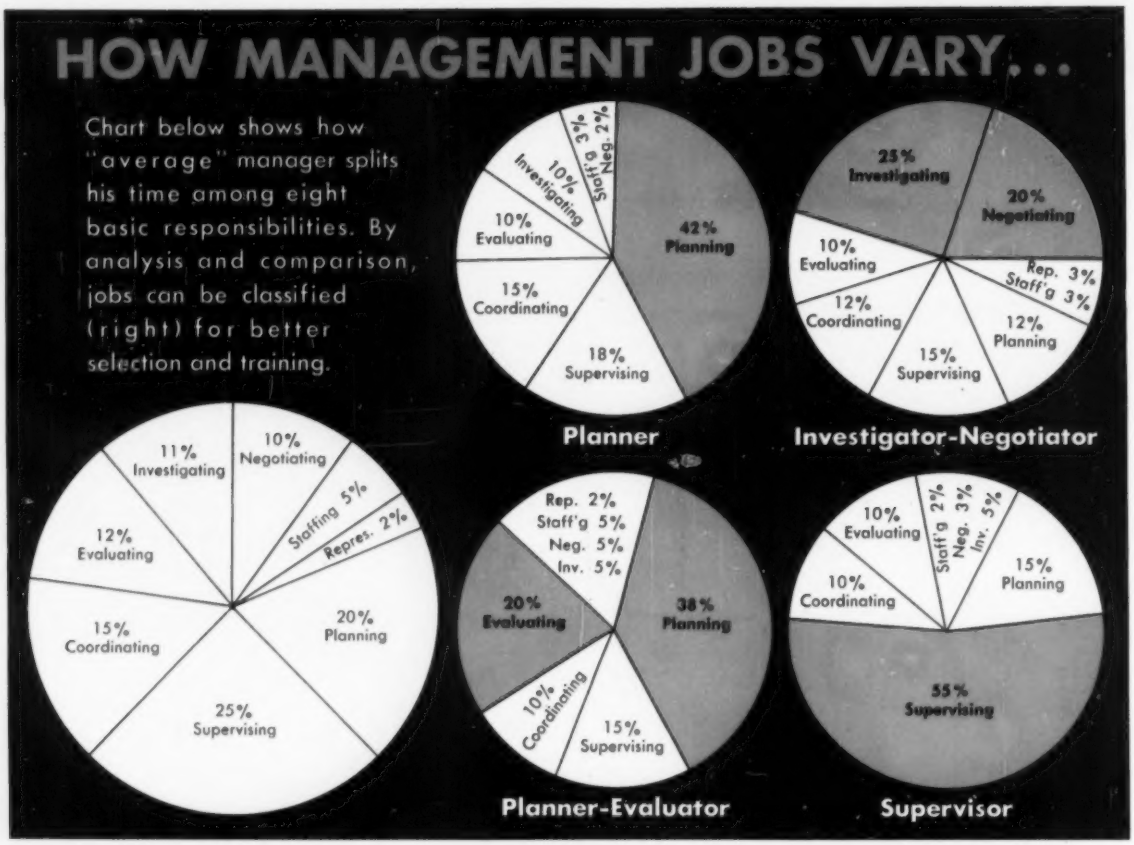


Defining the Manager's Job

Digested from FACTORY MANAGEMENT & MAINTENANCE, Dec., pp105,110

MOST MANAGERS would be hard put to define their job—just try it yourself if you have the time. If not, take a look at the charts above. This new technique was developed to compare management jobs without regard to position, title, or salary level.

Managers on all levels have basic responsibilities in common, the charts say. But, as you might expect, these eight responsibilities are an arbitrary selection. They were picked (in competition with as few as three, as many as fourteen) because working managers found this grouping the easiest to understand and apply in describing their duties.

The charts were prepared from an intensive survey of 241 managers, from $4,000-a-year assistant foremen to $36,000-a-year company presidents in commerce and industry, by the Management Development Laboratory of the University of Minnesota's Industrial Research Center.

From the survey results, an "average" manager was composed for comparative purposes—though note that the study indicates there is no typical manager or management job stereotype.

Management positions are classified by comparing them to the composite "average." A managerial category or class is formed as the manager's responsibilities increase above the average in one or more areas (compare the colored slices to the composite).

This technique can be used to throw light on the job responsibilities of working managers in a company. Or it can be used to design a consistent management network (perhaps in conjunction with the technique described on the right). Either way, the result should be more effective performance standards for selection, training, appraisal, and compensation.

As defined, the eight responsibilities involve:

—**Planning:** Determining goals, policies, and courses of action.

—**Investigating:** Collecting and preparing information — records, reports, and accounts.

—**Coordinating:** Exchanging information with people in the organization, other than subordinates, to relate and adjust activities.

—**Evaluating:** Assessing and appraising proposals or performance (reported or observed).

—**Supervising:** Directing, leading, and developing subordinates.

—**Staffing:** Maintaining the work force of one or more units.

—**Negotiating:** Purchasing; selling; contracting for goods or services.

—**Representing:** Advancing the general interests of the organization through speeches, consulta-

tion, and contacts with outside persons or groups.

In a preliminary report, the Minnesota researchers identified some of the more common and useful patterns of responsibility, based on groupings of 15 or more managers in the survey. Here are six composite portraits:

The Supervisor. He tends to be in a first-line supervisory position, and he spends less time than the others in planning, almost no time in representing, and average time in other responsibilities. His salary is less than average for the management group. His title might be shipping foreman, clerical section head, maintenance foreman.

The Supervisor-Evaluator. He spends twice as much time as the "pure" Supervisor in evaluating—almost a fourth of his time is spent in this area of responsibility. He is also at the first-line supervisory level, usually somewhat lower in salary and job title than a Supervisor. Sample titles: assistant foreman of assembly, assistant manager of policy issuance in a life insurance agency, foreman in an electric power plant.

The Planner. He spends almost half his time in planning activities—more than twice the "average" amount.

The Planner-Evaluator. He spends almost as much time on planning as the Planner, but twice as much in evaluating. He is about midway in the salary and organization level, usually slightly below the Planner. Sample titles: general service manager, production control manager.

The Investigator-Negotiator. He spends about a fifth of his time in each of these responsibilities, and he usually represents lower and middle management. His negotiations tend to involve relatively routine matters with other organizations. Sample titles: traffic manager, purchasing agent.

The Negotiator-Representer. He is likely to be in the middle or top layers of management, with a salary reflecting his position. It should be noted, however, that these two responsibilities—though considerably above average—still do not demand a majority of his time. Sample titles: vice president of operations, industrial relations manager.

A Rose is Always a Rose, But What is a Supervisor?

AS THE ARTICLE on the preceding page points out, a supervisor, unlike a rose, is not always a Supervisor. Other studies have underlined the same truth.

In a major study of foremen "contacts", two researchers in Yale University's (U.S.A.) Technology Project observed the minute-by-minute behavior of 56 foremen during full 8-hour working days. They found that the "average" foreman spends time with as many as 30 different people outside his own work group. And many of the foremen performed supervisory tasks as little as 3 of the 8 hours.

A major conclusion of the researchers: Many of the problems faced by foremen are beyond their control. The best way to improve the foreman's performance may be to redesign his job, with the aid of his associates.

In a practical demonstration of their diagnostic approach, these researchers helped solve a perplexing production problem in an engineering plant. Efficiency in this plant (in operation about 5 years at the time) had been steadily increasing except in the gear department, the largest group. The gear department was headed by a superintendent, with 2 assistant superintendents, 3 general foremen, 15 foremen and 450 production workers.

Top management had tried sending in teams of investigators, a foreman training program, departmental reorganization by product instead of process, foremen personnel changes, even a new department superintendent. But efficiency stayed below 70% in the department.

The Yale researchers picked one foreman who was highly rated by management and followed him around for a full working day (it is also possible to take such observations in random samplings over a period of weeks). They recorded everything he did—by topic, people involved, actual physical activity, location, how long it took. Then, in sequence, each incident was coded onto punch cards for analysis.

During the 480-minute day, this foreman performed 876 separate tasks. He spent nearly 45 minutes with time tickets, 50 minutes checking job lots, another 25 minutes moving material or arranging to have it moved. Checking tools, jigs, and fixtures took 55 minutes—and his general foreman filled in on one jig problem for 2 solid hours. And though his scrap and re-work problems were serious, he spent exactly 3 minutes in this area.

Bolstered with interview data, these observations were presented to top management. Faced with such clear evidence of organizational shortcomings, management took four steps:

—A production planner and clerk were assigned to each general foreman.

—A system of "move" tickets made an expediter responsible for routine material movements.

—The "tool-trouble" staff was transferred from the master mechanic to the department superintendent.

—Until better quality controls could be organized, a special "quality" operator was assigned to each foreman.

What had really happened was this: Management at all levels began to look at production problems with a fresh eye, from a new angle.

Top management discussed the problems with the department superintendent. He, in turn, held departmental meetings (for one thing, time standards were made clear to the workers). Production and quality report forms were redesigned.

Efficiency began improving; and within three years it topped 100%. The slight addition of auxiliary personnel was more than offset by other cost reductions.

And, finally, the plant dropped its classroom training program for foremen. Training, the managers agreed, had been effectively transferred to the shop floor. ●

Paying the Price for Business Advice

American management consultants are doing a bigger business abroad. Europeans especially welcome the services of the "business doctor."

Digested from BUSINESS WEEK, Dec. 21, p74

GROWTH, as one management consultant is fond of pointing out, brings problems—and business for the management consultant. For 10 years now, many of the world's industries have been expanding fast. Now—in 1958—they are meeting major problems.

Western Europe is becoming an especially fertile field for the consultants. You see the trend in the growing European business of such American firms as Booz, Allen & Hamilton International, George Fry & Associates, McKinsey & Co., Mead-Carney International, Lester B. Knight & Associates, H. B. Nayard & Co., and others.

You see it also in the decision of Bruce Payne & Associates, a firm that has concentrated its foreign efforts in Latin America, to organize a new world management corporation with offices in Frankfurt and Milan (MD, Jan.'58,p18).

I. Cause for Growth

The growing role of the American management consultant in Europe is a product of the Marshall Plan and of the productivity drive that has been carried on since then by the Organization for European Economic Cooperation.

The European Productivity Agency, which is part of OEEC in Paris, is working overtime to spread the gospel of advanced management techniques, thus clearing the way for this latest U.S. business invasion of Europe. On a recent trip to Europe, the head of EPA's Washington office discovered that there is intense interest among many European firms in what the U.S. management consultant has to offer.

EPA cannot claim all the credit for this new interest in better management. Part of it is simply the result of the rapid industrial growth that Western Europe has experienced over the last two years.

According to a consultant who has worked in France for 2½ years, nearly all European firms that have suddenly moved into the 5,000-10,000-employee class need management counsel. Another American consultant with wide European experience says that many family firms in Europe suddenly need, and now want, professional management.

On top of this, there is the new stimulus arising from the development of the European Economic Community, with its common market of 165-million population, and the associated Free Trade Area. Together, these may give Europe a mass market of 250-million. To many a business leader, this means tougher competition in Europe. It also means the need to prepare for it.

The management consultant field, of course, is not the sole property of American firms. A number of British firms, some of them with close American links, are working both in Britain and on the Continent. France and the Netherlands each has its own association of management consultants; West Germany has them too, as well as a government consulting service.

But correspondents in Europe unanimously report that the demand for consultant service from the U.S.A. is considerable, especially from companies in West Germany and Italy.

Cost control, inventory control, and organization planning are the services most in demand by European industry today. But advice on packaging, marketing, research, and office management is also sought after, and many parts of Europe provide virtually virgin territory for such service. In some cases, the U.S. management consultant is asked to provide advice on how to enter the American market.

Up to now, manufacturing companies have shown the most interest in taking on American consultants. For example, about 80% of the work that Booz, Allen & Hamilton does in Europe is with manufacturers. In the U.S. only 50%-60% of this firm's work is with manufacturing.

What the management consultants are doing is simply to follow in the footsteps of the engineering consultants, who have been operating throughout the world for many years. The early part of the American management consultants' drive for foreign clients took them most often to Latin America, and occasionally to the Middle East, the Far East, and Europe.

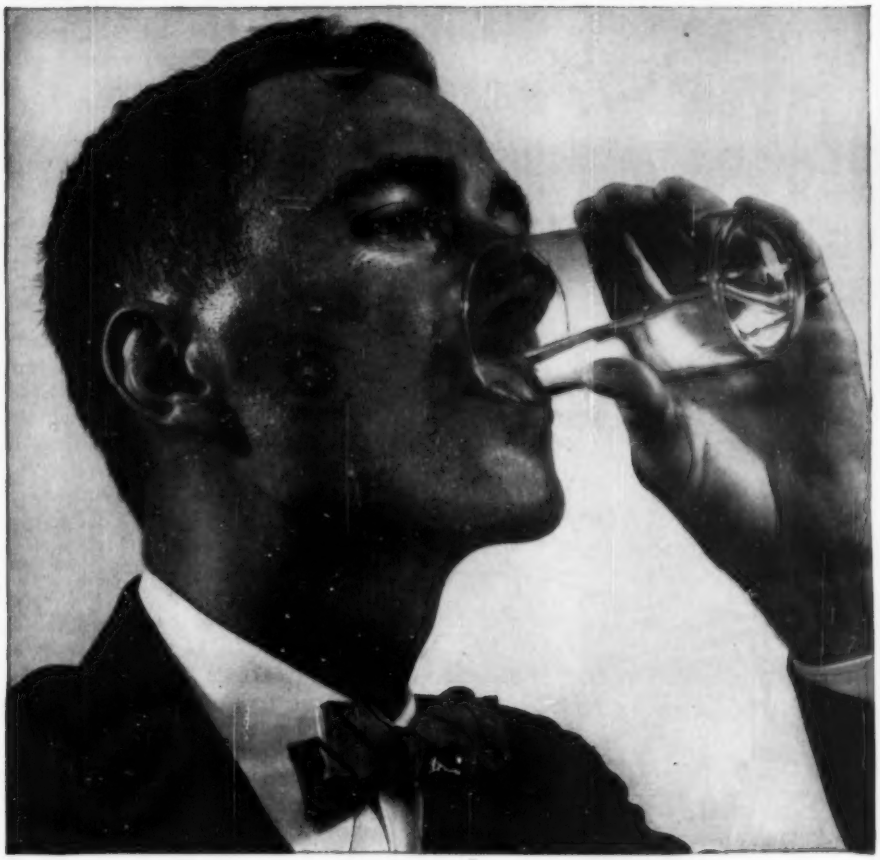
Now, these broad-gaged general management engineers are beginning to win important contracts from a large and diverse group of enterprises—government oil monopolies in Brazil and Italy, private oil companies such as Royal Dutch Shell, sugar centrals, trading companies, metalworking shops, and steel empires.

A lot of work is being done, too, for the foreign branches and affiliates of U.S. companies. For example, Bruce Payne & Associates works for Gillette in Boston, U.S.A., Sao Paulo, Brazil and Buenos Aires, Argentina.

Several firms report that their foreign business is growing by 35% a year. All told, their combined business abroad must reach into several millions of dollars each year.

McKinsey & Co. is one American firm with a sizable foreign business that still operates overseas by sending consultants out from its U.S. offices. Sometimes these men stay abroad for a year or two. By using this system, McKinsey & Co. feels it can guarantee a foreign client exactly the same type of management advice as it offers in the U.S.A.

On the other hand, Booz, Allen & Hamilton, which operates in 15 countries, has a big office in Europe (Zurich, Switzerland) and plans to open one soon in Sao Paulo. George Fry & Associates also has an office in Europe (Frankfurt), is opening one soon in Iran, and may add a second



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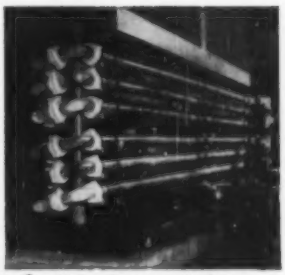

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European office in Italy. Mead-Carney now does most of its work in Europe—and has clients like Philips in the Netherlands, Siemens in West Germany, Simca in France, and Fiat in Italy. These consultants believe they can do a better job by having a staff of consultants stationed abroad.

When Bruce Payne & Associates gets its two European offices under way early this year, it will have about 100 men working abroad, equalling the size of the U. S. staff. As is the case with other firms having offices abroad, Payne's overseas staff will be partly American, partly European. And Payne's European offices plan to ask for the same fees as the firm gets in the U. S. A.

II. A Morning Glory?

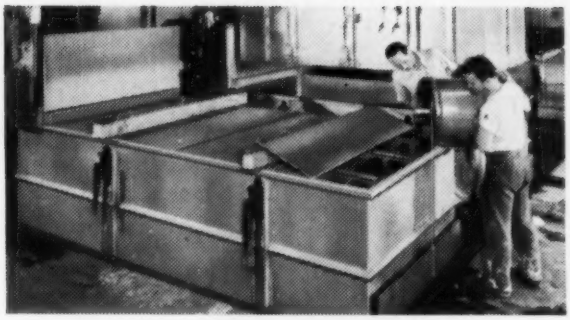
There may be troubles in Europe for the American consultant. In fact, you will find people in the consulting field who question the present enthusiasm of the American consultants for overseas business.

The skeptics reason that the high fees charged by the ranking American firms—roughly $100 to $200 a day for the services of a qualified consultant—will finally kill the boom. They fear that either European firms, with much lower fees, or less meticulous Americans, with lower-quality services, may finally get the bulk of European business.

According to widespread reports, considerable damage has already been done to the standing of American management consultants by "get-rich-quick" operators in the immediate postwar years, and by the methods used by at least one U. S. firm now in business in Europe.

There is also the resistance of the very conservative-minded European businessmen, who still constitute the majority despite the work done by the European Productivity Agency. One American consultant with experience in Europe draws a parallel between the attitude toward "modern management" of the average European businessman today and that of the New England (U. S. A.) businessman of 25 years ago who was firmly convinced that no one could teach him anything. ●

gins, an executive with a legal back- come competent in MTM. (*Metal-*



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REPRESENTATIVES IN PRINCIPAL CITIES OF THE WORLD

In Management

● **THE TRIUMVIRATE form of corporate responsibility**—with authority vested in a three-man policy and finance committee—has been adopted by the U. S. A.'s Westinghouse Electric Corp. (which in 1957 closed its first $2,000-million sales year).

Westinghouse is discarding the title of "chief executive officer," which Gwilym Price held as president and chairman of the board. Price will continue as chairman of the board, and will head the three-man committee.

The second member of the triumvirate will be Mark W. Cresap, with the title of president and chief administrative and operative officer. Cresap is a former management consultant who has been groomed for his new job for five years. He will report directly to the policy and finance committee, instead of to the board. In this way, insiders say, Price will maintain his position as "top man" in the company.

The third member will be the vice president and secretary, E. V. Huggins, an executive with a legal background. Huggins is also chairman of the board of directors' executive committee.

The purpose of the change is to diffuse managerial responsibility. A triumvirate management has long been associated with the giant U. S. Steel Corp.

● **RENAULT, the French automobile maker, has adopted the MTM** (Methods-Time Measurement) system of predetermined motion-time standards—for setting standard times on repetitive manual operations and for measuring the operator's work in machine operations. Stopwatches are still used on machine operations themselves.

Renault spent two years experimenting with the system before adopting it, and the company has enough faith in MTM to set incentive payments by it. Employees have also shown more confidence in MTM than time studies—several MTM checks have been requested.

According to Renault's experience, it takes at least six months for a good methods engineer to become competent in MTM. (*Metalworking Production, Dec.* 20, *p*2285)

● **OPERATIONS RESEARCH studies are spreading through U. S. industry.** Of 631 companies surveyed by the American Management Association, 324 (51%) use Operations Research, and 144 others are seriously thinking of doing so. This compares with an estimated 85 companies that were using OR in 1953 and virtually none in 1951.

Although it has many definitions, OR is generally described as the application of statistical theory, mathematics, and formal logic (the scientific method) to solving business problems or improving operations. Applications reported vary from highly specific department studies to companywide projects such as the programing of complex production runs.

Another important and growing application, according to the AMA survey, is in long-range planning. More and more, management is asking OR teams for studies on whether to build new plants and where to locate them, and on how extensive research efforts should be. (*Business Week, Dec.* 7, *p*90)

● **PAY WORKERS by the month instead of weekly**—urges the German AWV management group of the European Productivity Agency. And pay them with direct deposits into individual bank accounts, rather than the stuffed envelope.

A number of firms in Europe and the U. S. A. already use this pay method with success. Bank deposits bypass counting payrolls and stuffing envelopes. And the system would reduce the "status barrier" between weekly and monthly paid employees.

There seems no reason that "workers" as a class are more irresponsible with their money than anyone else; and there is no evidence that a person's ability to manage his money depends on how he is paid. In fact, the chances are that a worker would save more if paid in a monthly lump sum than in smaller weekly amounts.

Of course, local conditions might make it more desirable to use postal checks or some other banking system instead of regular bank deposits.

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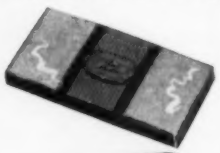

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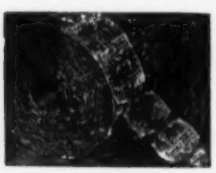

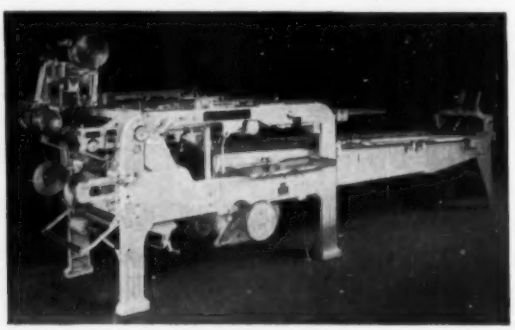

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GENERAL CHEMICAL: Basic heavy chemicals; "BAKER & ADAMSON" Laboratory Reagents, agricultural chemicals; and "GENETRON" refrigerant and propellant gases.

NATIONAL ANILINE: Dyes, certified food colors, intermediates; "CAPROLAN"—the new concept in nylon—and "NACCONATE" isocyanates for urethane foams.

NITROGEN: One of the world's foremost producers of nitrogen products, including ammonia, urea, sodium nitrate and "ARCADIAN" fertilizers as well as petrochemicals, such as ethylene glycol, ethanolamines and methanol.

SEMET-SOLVAY: First in merchant coke production, supplies "A-C" Polyethylene for coatings and waxes, builds "WILPUTTE" by-product coke ovens.

SOLVAY PROCESS: Leader in alkali production, also chloromethanes, hydrogen peroxide and aluminum chloride. Supplies "MUTUAL" chrome chemicals and "KOREON" for leather tanning.

ALLIED CHEMICAL INTERNATIONAL: Sells and services all of these products to overseas customers throughout the world.

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▶ YOU AND YOUR PERSONAL AFFAIRS

Have you ever thought of collecting coins? It can be a profitable as well as fascinating hobby—and is well suited to the travelling businessman.

In a recent front-page story, the *Wall Street Journal* reported that many scarce coins have increased in value 400% to 500% in the past five years. The reason is simple: There is a fast growing number of collectors—or numismatists, as they are called—bidding for a steady supply of old coins.

Dealers are trying to buy back coins they recently sold to collectors—at anywhere from 25% to 100% above the former selling price. There is even a new bid-and-asked market, conducted by the U. S. A.'s National Coin Exchange (Cincinnati, Ohio, U. S. A.).

As a result of the possibilities for profit, coin collecting attracts a rising number of investors and speculators. But dedicated hobbyists take the attitude that you should not collect unless you enjoy the hobby. As one told the *Journal:* "If you make money, too, that is fine. But a collector shouldn't go into it for profit."

Collectors usually specialize in a particular kind of coin—such as ancient, foreign, colonial, papal, commemorative. The great faces of world history are struck for posterity on coins, and a nation can be studied through its coinage.

Many collectors prize unusual items—such as King James "gun" money made from melted-down guns, "bullet" money from Thailand, knife and razor money from China.

The "average" collector, as judged by members of the American Numismatics Association, owns coin worth between $1,000 and $5,000. Wealthy collectors, of course, possess individual coins worth more than this average.

But don't get the idea that age and price necessarily go together. A Greek Athenian silver drachma can be bought for as little as $1; and a 2,100-year-old silver Roman denarius can be had for $2.50. In fact, many ancient coins are in surprisingly good supply.

Condition is a major determinant of price. Uncirculated and "like-new" coins are much more valuable than worn coins. An example: One U. S. coin commands $115 if uncirculated, only $1 if classed as in "good" condition. And dealers have more than half-a-dozen classifications for condition.

Most coin collections are kept in special folders with slots marked for certain coins, and you can buy these folders from a dealer. You can also get a variety of books on the subject.

●

If you should happen to meet a French journalist named Francois Pasqualini, you might be convinced that you should learn shorthand. Writing in the U. S. journal *Business Education World,* Pasqualini argues that taking notes in longhand is "an educational fossil kept alive by generations of routine-enslaved men."

"Routine-enslaved" or not, you might want to consider the idea. Experts say you can learn enough shorthand for business note-taking purposes in about six weeks, based on evening courses in a secretarial school (of course, you can arrange for private instruction). And if you don't care for the symbol systems, many languages have been reduced to a system of standard abbreviations.

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"But all it needs is a new handle," the customer exclaims on seeing a trio of product service men. Too much is too much, marketing men agree . . .

Yes, But How Much Product Service?

Digested from INDUSTRIAL MARKETING, Dec., p53

POOR PRODUCT SERVICE can kill repeat sales fast. And when word of sub-standard service gets around, many initial sales will be lost too. But how much product service is enough? That is the question.

Some say there is never too much.

Others answer, "Whatever you can afford"—and this is not a simple answer.

Unfortunately, little research has been done to find out when product service ceases to pay off. This may be because of the complexity of the problem. Markets shift rapidly and products themselves change.

The job can be greatly simplified by the use of basic checkpoints against which product service can be measured. Here are 11 developed by the Appliance Motor Department of General Electric Co., which may prove helpful in measuring your program:

—**Cost.** The obvious first step is a complete cost analysis of your present service operation and cost estimates of alternative courses of action. Necessarily, some estimates will be rough. A thorough inspection of cost department records will prove valuable. Such indirect items as service promotional expense should be included. And the end result of a complete cost study must be a management decision as to just how much service the business can afford in relation to the sales volume expected.

—**Volume and variety of products and models.** A standardized, low-value product such as an industrial lamp lends itself to straight replacement from regional stock. However, a warehouse replacement plan for another low value item with wide model variety might burden your service warehouse with unbearable inventory costs.

—**In-warranty vs. out-of-warranty service.** The demands of service within the normal warranty or guarantee period may be quite different from those required after the expiration of the guarantee. What does the product require in the way of warranty? What is your ethical liability and what is competition doing in this area that you are not? Are you being too liberal in warranty settlements?

These questions must be answered before you can develop the best organization and procedures. Out-of-warranty service, which is primarily at the customer's cost, poses other problems—obsolete parts, stocks and special manufacturing runs. Your service program should be able to handle both.

—**Quality of service.** High quality service is always desirable, but there is an optimum point, usually measured in cost, that is best for the individual business. Where is this point? What is the best way to achieve it? Large steam turbines, for example, require highly trained factory representatives for proper service. Small electric motors also can be expertly repaired at the factory, but any reputable motor repair shop can do the job nearly as well at much less cost.

—**Field failure information.** Nothing can be of more value to quality control and production organizations than prompt and accurate information on the volume and cause of field failures. Proper interpretation of this data—from salesmen, engineers, service personnel—can result in greatly improved designs and manufacturing techniques. What information does your business need? The availability of this information is usually directly proportional to the amount of control over service.

—**Size and quality of headquarters and field staff.** The staff required by a service organization must fit the company's resources. If examined only for cost, the size and quality of your present service staff may be too much for your

actual requirements. But don't forget to consider long range manpower planning and training facilities. A factory branch organization might offer superior service; independent servicing agents often can do the job cheaper.

—Actual control over the servicing operation: It is probably true that the more engineering that goes into your product, the more service responsibility you must bear. Yet it is easy to overestimate your company's "unmatched knowledge." As a general rule, retain as much direct control as is economically feasible, but don't ignore the contribution which could be made by the independent service contractor.

—Speed of service. Service can seldom be too fast, especially in the case of in-warranty service complaints. Most customers expect a small amount of field failure in your products. They also expect you to have an organization ready to get the trouble fixed fast. But how fast? What do they think the average time lapse from product failure to completed repair or replacement should be? After answering this question, you must decide what is the best way to meet this goal, balanced with the economic factors.

—Service for a variety of products and customers. Many times it is not possible to service all products with the same organization. Still, you should make a careful examination to determine whether a service plan is available which could handle two or more product lines now serviced separately. Also, is your program sufficiently broad to handle large and small customers in the same manner? Service allowances should be equal for all customers.

—Service equal or better than competition. Remember, inferior service loses more sales than superior service can gain. While service better than that of the competition might be desirable, you should be certain that it is at least equal to your competitors—not from your point of view, but in the eyes of your customers. You may need a market study. This information is as important as any you can have in the marketing area.

—Knowledge of long term trends. Rising service costs may make it more desirable to replace than repair equipment. Rising manufacturing costs, on the other hand, may make it more economical to repair than replace. Can your present organization handle the service volume expected in 1960? How about new products? It would be costly to develop a large organization for product repair when you are developing a product which will need little repair. ●

How to Push a New Product

The way to do it, the experts say, is to establish a separate department that can shepherd new ideas.

Digested from BUSINESS WEEK, Dec. 7, p95

A few weeks ago, 400 executives quietly endured two days of sitting in stiff-backed chairs—all for the sake of attending an American Management Assn. conference on new products.

From the number of high-priced men lured from snug offices to the relative discomforts of a hotel ballroom, it was obvious that the sessions had stirred considerable interest. What inspired them was a feeling that product development needed new status—equal to research, manufacturing, and marketing—to replace its present obscure position in the corporate hierarchy.

There are good reasons for this concern. Surveys show that the odds are 5 to 1 against success for a new product after it reaches the market. And the U. S. A.'s General Foods Corp. found in a study of its own that 70% of the successful newcomers will be obsolete in 10 years. Against these handicaps, product development men are constantly under pressure to find new ideas to outsell the competition.

The AMA speakers made plain that, despite the pressure of competition, many companies are still without organized product development programs. They attributed the confusion to two major factors:

—Failure by management to appreciate the complexities of introducing a new product into today's markets. The prescription: better coordination of market research, basic research, manufacturing, and sales.

—Reluctance of various departments to surrender any of their control in the development of new products. As a result, they are frequently at odds with each other.

AMA planned the conference to discover the methods used by companies known for successful new product development. As it turned out, the methods vary—but, basically, all the companies make use of a planning group that concentrates on product development.

The difference of opinion is whether the group should be merely advisory—as at American Standard Products Inc.—or an operating arm of the business—as used by General Electric Co.

American Standard nurses its new products with a committee consisting of representatives from each major division of the company—research, engineering, manufacturing, market research, and sales. The committee meets from time to time during all stages of product development to discuss the problems faced by each department. Then it advises top management on the best way to resolve any differences. But it doesn't make any direct decisions.

General Electric, on the other hand, establishes a product development group within each division. An operating section of the company, it is responsible directly to the division general manager. In plotting the development of a new product, its first job is to evaluate objectively the manufacturing capacity, competitive products, and market size. Then it tells the various departments what is expected of them. From this solid foundation of facts, the product planning group supervises all phases of development.

However, as the AMA speakers pointed out almost apologetically, there's no panacea for the new product problem. In their view, a formal new products department is just the first step. ●

A Serious Threat to Retailers?

A West German idealist confounds merchants by taking discount orders for merchandise by mail

West German retailers are boiling mad at Hugo Schui. Consumers love him; and many manufacturers are cautious but cooperative.

Schui, a government functionary, is the man who started taking mail orders for merchandise in his spare time, and, for a small commission, routing them to the manufacturer for direct shipment. Within months Schui's Kaeufer IG. (Purchasers Confederation) was passing along 700 orders a day for all kinds of household appliances, electric razors, radio and television sets, bicycles, sewing machines—anything a customer asked for.

Schui's mail order discount selling, like Paris' first successful "discount store," Chez Monsieur 20% (MD, April '57), is a sign of the times. "Fair-trade" pricing—that is, prices set by the manufacturer—is under assault around the world.

But Schui goes one step further than the discount house. Kaeufer IG. puts out only mimeographed leaflets listing product categories and the percent discount. The organization carries no stock, and has no warehouse or display expense. Retailers argue unfair competition: that they supply the showwindow for Kaeufer IG.'s customers; that their shop rental money is going into Kaeufer IG.'s pockets.

Manufacturers cooperate with Kaeufer IG. with caution. They fear a boycott by retailers, and many use a fictitious sender's address when they ship the products.

For the consumer, there is a certain amount of uncertainty. He does not know what brand he will get, or even exactly what price he will pay. But the uncertainty is not enough to overcome the desire for discounts averaging 10% to 25% below retail prices. Consumer associations support Kaeufer IG. as evidence of their claim that retailers profit margins are too high.

Is Hugo Schui a serious threat to West German retailing—or just a Don Quixote tilting at commercial windmills? To date, he and a couple of friends have handled orders at home in their spare time—as much for idealistic as for materialistic reasons.

But now, with the mail sack getting heavier by the day, Schui is faced with the necessity of hiring full-time employees and renting offices, which add up to overhead in even an idealistic set of books.

It is a question how much of a bite selling costs will take out of Kaeufer's discounts. But it seems certain that the discounts will remain well below the retail level. And the fact remains that Schui can sell anything that has a name and a price, and a manufacturer who cooperates. ●

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▶ FINANCIAL DIGEST

Activity in the U.S. government's program to guarantee American investments abroad has shifted sharply from Europe to the less industrially-developed nations.

Under the guarantee program, U.S. direct investments abroad (excluding private "portfolio" investments) are insured by Washington against losses due to inconvertibility of profits or capital, expropriation or war. The U.S. investor pays an annual charge of ½% of the value of its investment. Until two years ago, most of these guarantees went to companies investing in Europe.

Now nearly 70% of the $700-million backlog of applications is for investments in underdeveloped countries—where U.S. businessmen fear the consequences of present and potential economic and political instability. And there is increasing interest among these nations in the program.

—India recently signed a convertibility guarantee agreement with the U.S. Several other Asian countries may follow.

—In Latin America, only Haiti had signed an agreement two years ago. Since then 10 others have signed, and another half dozen countries appear ready to join.

To date, there have been no claims for compensation. But the program may be hotly debated in Congress this session.

●

Brokers and businessmen are talking about Royal Dutch Petroleum Co.'s huge new financing for expansion and development through an international syndicate of underwriters. U.S. firms—176 in all—are taking up about 60% of the issue, with 32 European firms taking the rest.

Wall Streeters say this is the first American participation in such an international underwriting. **It is one of the largest ever carried out:** Royal Dutch expects to raise between $200-million and $250-million.

Royal Dutch is offering 7.6-million shares to its shareholders—one new share for every eight outstanding. About 37% of outstanding shares are held in the Netherlands, 28% in the U.S., 23% in France, and smaller amounts in other countries. The U.S. percentage is now expected to rise, as European holders sell rights to U.S. underwriters.

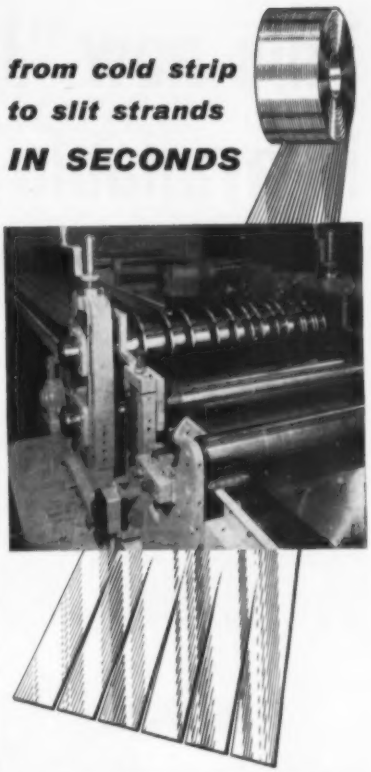
Royal Dutch, a Netherlands-based holding company, owns 60% of the Royal Dutch Shell oil empire. The other 40% is owned by Britain's Shell Transport & Trading Co. Ltd., which is also selling new stock, via British firms.

●

Another news-making issue came from Argentina's state oil agency, Yacimientos Petroliferos Fiscales. Its recent 500-million pesos ($12.5-million) bond issue was snapped up by investors, and for good reason: a basic 6% interest rate, automatically increasing (up to a maximum of 20%) as (and if) oil is developed. As further bait, the par value at maturity (15 years) will be adjusted for currency depreciation (based on changes in the average salary of workers).

But brokers noticed repercussions in the bond market. They say that many investors sold regular government 3½% bonds to buy the oil agency's "bonanza bonds." The financial community warned against overestimating the ability of the Buenos Aires market to absorb new issues.

from cold strip to slit strands IN SECONDS



YODER ROTARY MULTIPLE SLITTERS

A Yoder slitter converts mill-width coils of flat-rolled metal into many variable-width strands in amazingly short time. Speed, coupled with great accuracy and low manpower requirements, makes a Yoder slitter an important factor in keeping production and overhead costs down.

Operated by only two men, the Yoder Type 3-48 slitter illustrated is designed to accommodate standard mill-width coils up to 48 inches wide, in a variety of metals and thicknesses. The slit strand widths can be held to within a .004" tolerance.

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New GM "71E" Diesel can cut gasoline engine operating costs in half.

This General Motors Series "71 E" engine for trucks and buses is the newest version of the time-proved GM 2-cycle Diesel, popularly known as the "Jimmy" Diesel to users the world over.

It will save more money, perform better at all speeds and last longer than any other engine on the road today—for these important reasons:

MODERN 2-CYCLE ADVANTAGES—more power per size and weight—twice as many power strokes per crankshaft revolution as 4-cycle Diesels—smoother running—faster accelerating—better high-altitude performance.

NEW 4-VALVE CYLINDER HEAD and 38% larger air intake capacity for improved combustion and the cleanest "breathing" known—smoke-free exhaust.

UNIT FUEL INJECTION—with new free-flow spray tips—more "go" per gallon—maximum output on minimum fuel.

LOWER MAINTENANCE COSTS—simpler design requires fewer maintenance hours, and maximum interchangeability of low-cost parts assures lowest costs over the entire life of the engine.

See your GM Diesel distributor about repowering your present equipment. When you're in the market for new trucks, ask for this great new GM "71E" Diesel. And if the truck you choose isn't immediately available with a "Jimmy", turn your truck over to the GM Diesel distributor for a "71E" installation.

Here's how a "Jimmy" Diesel fits your truck

LOAD	MODEL	HORSEPOWER
35-45,000 GCW	"4-71E"	140 gross HP @ 2100 RPM
40-60,000 GCW	"4-71T"*	171 gross HP @ 2300 RPM
50-76,800 GCW	"6-71E"	210 gross HP @ 2100 RPM
60,000 GCW and up	"6-71T"*	236 gross HP @ 2100 RPM

*New GM Turbopower Diesels—higher power with little increase in size or weight

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GENERAL MOTORS LOCOMOTIVES

Small Firms Look to Science

A wealth of free research, plus the services of cooperative and independent laboratories, is available to the company with initiative, but with limited funds.

Digested from BUSINESS, Nov., p66

MISSILES, satellites, and nuclear energy dramatize the impact of research on our times, but they are only part of the picture. The laboratory today controls the most practical aspects of industrial life. Evidence of this can be seen in the speed with which technical changes have been taking place. Improvements pile on top of improvements, new products give way to newer products, and research becomes a critical weapon in the fight for business survival.

The world's productivity has expanded by leaps and bounds in the last few years, and one of the main reasons has been the unprecedented upsurge in industrial research. Half of today's manufactured products can be traced to work done in the laboratory.

Companies of all sizes find they can not afford to stand aloof from this parade of research. If they do, they may see their markets and profits disappear into thin air. Their very survival in many cases depends on their ability to undertake research, or at least use the work of others.

Progressive small firms are aware of this situation, but they also know that research is costly. Specialists and technicians command high salaries, and some of the needed research equipment is far beyond the reach of small and medium-sized companies.

Three avenues are open to these smaller firms in their efforts to guard their competitive position: 1) An organized program to keep informed about technical developments; 2) Participation in joint research projects; 3) Use of independent research institutes.

I. Keeping Informed

For a small firm, a good technical librarian or information officer may be worth several scientists. A vast fund of vital research knowledge is available in scientific papers and technical journals. But a small company's scientific men do not have the time to read all the literature that may interest them, nor do they have ready access to it.

A good information officer combines a knowledge of sources of information with an awareness of the special needs of his firm. By reading and condensing pertinent literature, he can save his firm many hours of work in its own laboratory.

Even with a talented information officer, the task of keeping abreast of technical happenings is exhaustive and increasingly complex. Reading the available literature is not enough; the information must be stored and indexed in such a manner that it can be readily available when needed.

With the example of the comprehensive Russian data-collecting system before them, both American and British governments have been pressing recently for more adequate facilities for gathering and abstracting the world's published scientific information. A debate in the House of Commons called attention to the fact that many small firms in England were unable to trace information which they knew existed, simply because there was no comprehensive index.

Despite this self-criticism, extensive sources of information are available in the U.S.A., England, and elsewhere. For 40 years the British Department of Scientific and Industrial Research has been gleaning information, collating it, and encouraging firms to use it. Large American firms and governmental agencies constantly are releasing the results of their research, much of which is then published in engineering and scientific magazines.

The U.S.A and England pool their resources in the compiling of abstracts. For chemical and medical abstracts England relies heavily on American organizations —the American Chemical Society's *Chemical Abstracts*, and publications of the American Medical Association—while the U.S. uses British abstracts in physics, engineering, and radio.

Another source of valuable research information for small firms is the patent office. Many firms employ patent officers who sift relevant patents as they are filed. Others use the services of an outside patent agent.

A new international patent service at The Hague publishes in English the *Interpas Monthly Patent Data*, which abstracts the patents of 21 countries. Each patent is coded and full information is available at reasonable cost. The European Productivity Agency publishes brief technical abstracts from a host of scientific journals.

II. Cooperative Research

Many small firms have turned to sharing research costs with other firms who have similar problems. This is done under the auspices of trade and industry associations. Such joint effort gives a firm expanded technical facilities and personnel—but it also means the sharing of the answers of research as well as its cost, which discourages some companies.

Cooperative research associations serve about two-thirds of British industry. There are now 46 of them, supported jointly by the Government (through annual grants by D.S.I.F.) and by member firms.

These associations conduct research into the problems of the industries they serve, and publish the results for the benefit of their members. Most of them publish bulletins covering their work. Their libraries

and information services are available to members.

Many firms do not use the research efforts of their association, ignoring its bulletins and questionnaires. England's Cutlery Research Association failed due to lack of support after years of service to scissor and knife manufacturers.

Foreign competition and dwindling profits, however, brought a new Cutlery Research Council into being in 1952. The new organization has done an outstanding job in the past five years, working in close liaison with factory managers.

III. Contract Research

Private (sometimes non-profit) research organizations that do work on a fee basis play an increasingly important role in the U. S. A. and Europe—and they seem more and more interested in foreign contracts (MD, June '57, p20). Such laboratories have existed in the U. S. A. for years, the first two being the Mellon Institute (started in 1913) and the Battelle Institute (1929). Others prominent in U. S. applied physical and chemical research are Stanford Research Institute, Armour Research Foundation, and the Arthur D. Little organization. In England, the Sondes Place Institute employs a staff of 80 and specializes in applied chemistry and chemical engineering; the Fulmer Institute, with a staff of 100, concentrates on metallurgy.

Small firms have found independent research groups of great value. Extensive laboratories, giant research tools, and a wide variety of specialists are made available to clients. The cost normally depends on the man-hours employed, with some allowance for instrument depreciation.

All work done by the institute is confidential; the results are communicated to no one but the sponsor. Any patent rights arising out of the research project belong to the sponsor.

Institute facilities also are useful to firms requiring research outside their normal interests. A company developing an anti-corrosion hull paint may have experts on paint, but know nothing about marine biology. It can contract to have the biological work done at the institute, where it can be done more quickly and cheaply than by the firm itself.

A small company's demands from research are modest. Its main concern is to insure its competitive position in the industry. If it cannot undertake research, it can at least take advantage of it—by keeping informed on the research in its field done by others. For special projects, the firm can call upon trade groups and institutes. ●

Chemicals That Remember

Digested from BUSINESS WEEK, Dec. 7, p120

The human brain uses chemical reactions to store tremendous amounts of information in its small space. Can a man-made system do the same?

Researchers of U. S. A.'s National Cash Register Co. believe they have found a partial answer. They have developed a chemical memory system that combines research on light-sensitive dyes with a new method of enclosing liquids in microscopic capsules. Coated on paper, the dye capsules offer a medium for storing and recapturing information by light waves.

The thinking at National Cash Register is that their system can one day replace electronic memories in high-speed computers. Computers use magnetic cells with two basic reference positions. When a cell is magnetized, it signifies one bit of information or one digit; when it is demagnetized, it takes on a different meaning. Dye-coated paper would act in the same way: Dark spots would replace magnetized cells; and colorless spots, demagnetized cells.

Here is how the system might work: An electronic device would transfer information to the paper by rapidly changing wave lengths of light, implanting a pattern of microscopic dark and light spots. The data then could be recaptured by scanning the paper with a light-sensitive cell.

Memory work is not the only potential job for the NCR capsules. Their use in food processing is being studied. One prospect is the capture of coffee in tiny bubbles; they might later be released by heat with all the coffee's original flavor and aroma. Studies also are under way on encapsulating drugs and on implanting perfume capsules on cleansing tissue. ●

Tires Vulcanized by Radiation

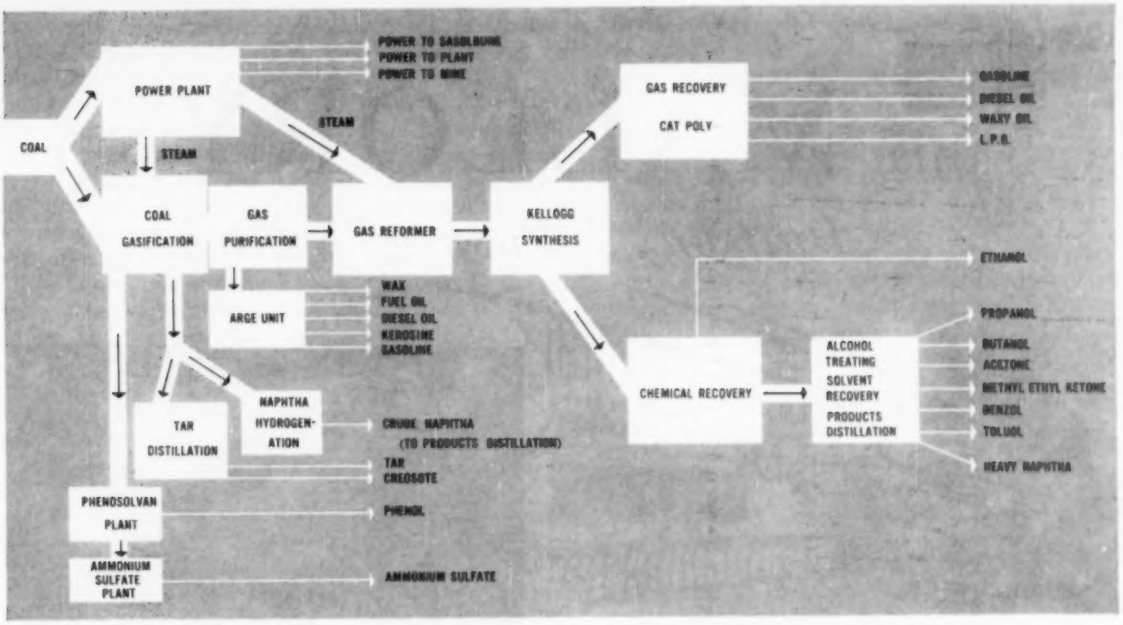
Radioactive by-products of atomic reactors have moved into scores of practical uses—tracing photosynthesis in plants, gaging metal thicknesses, refining gasoline,monitoring material wear and decay. Laboratory work shows a broad future for radiation in material processing—most recently, in place of vulcanization of rubber.

Tires vulcanized by radiation in the laboratory of B. F. Goodrich Co., U. S. A., turned out a product that wears and ages as well as a conventionally-vulcanized tire. Further development may mean a major advance in tire quality.

The tires were treated with spent fuel elements from the firm's materials testing reactor. Irradiation took place near the bottom of a 2-meter-wide canal containing about five meters of water. Twenty fuel elements were placed on an aluminum table in two rows, and then the tire and its heavy steel mold were slowly rotated above the elements.

A standard automobile tire was used, made of a synthetic rubber (GR-S) tread and a natural rubber carcass. Goodrich researchers felt this offered the challenge of bringing all parts of the tire to optimum cure with one exposure.

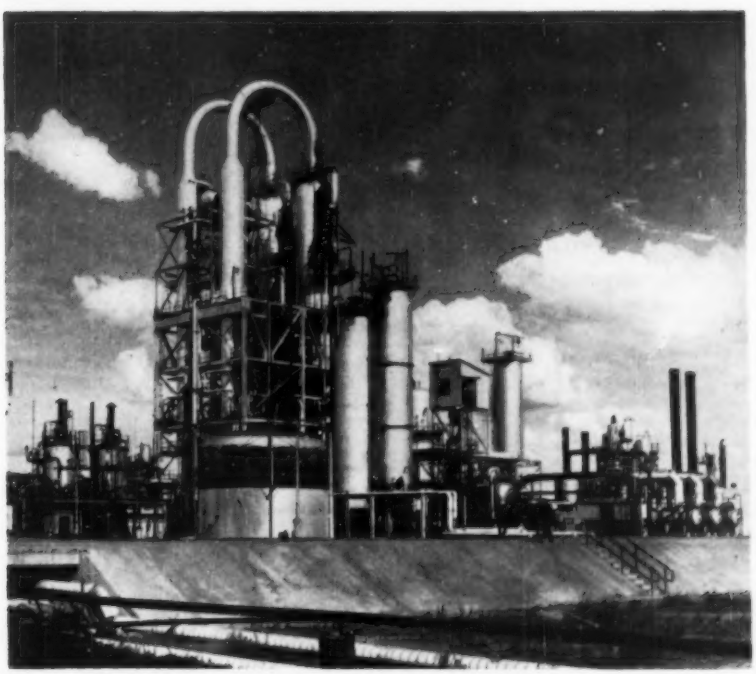
Though the tires have lived up to all expectations, radiation vulcanization is still a long ways off as a practical application. The radiation dosage required is too large, and the cost is prohibitive. Vulcanization of a tire by the normal sulfur-and-heat method normally costs less than a dollar; it costs about eight times that much by radiation. But indications are that radiation costs will drop in the future—by cheaper elements and an improved process that will use less radiation. (*Nucleonics, Nov., p* 94).



SASOL'S COAL is gasified, purified, then synthesized in Arge or Kellogg units into liquid fuel and chemicals.

Coal-to-Gasoline Proves Profitable

Nations with coal, and without petroleum, are studying South Africa's efforts toward fuel independence.



SYNTHESIS UNIT in South Africa, designed by Kellogg engineers, reacts carbon monoxide and hydrogen to produce hydrocarbons and oxygenated chemicals.

SIX YEARS AGO the South African government hired the American engineering and construction firm of M. W. Kellogg Co. to build a plant near Johannesburg that would turn low-grade coal into high-grade gasoline. No commercial works of this kind existed at the time, nor has anything equal to it come into being since.

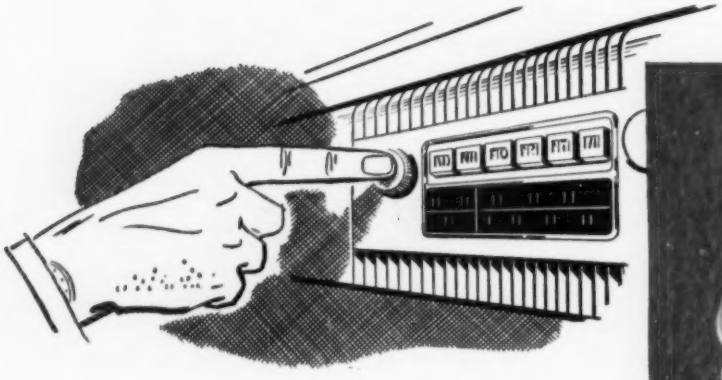
Governments and engineers watched with some misgivings as $60,000,000 to $65,000,000 worth of American and German equipment went into construction of the plant. Would it produce a gasoline of use to Johannesburg motorists? Would this fuel be competitive with that made from imported crude oil, in view of the high cost of the plant? Does the process offer an answer to other countries—Spain, India, Belgian Congo—who have coal but must pay top prices for oil?

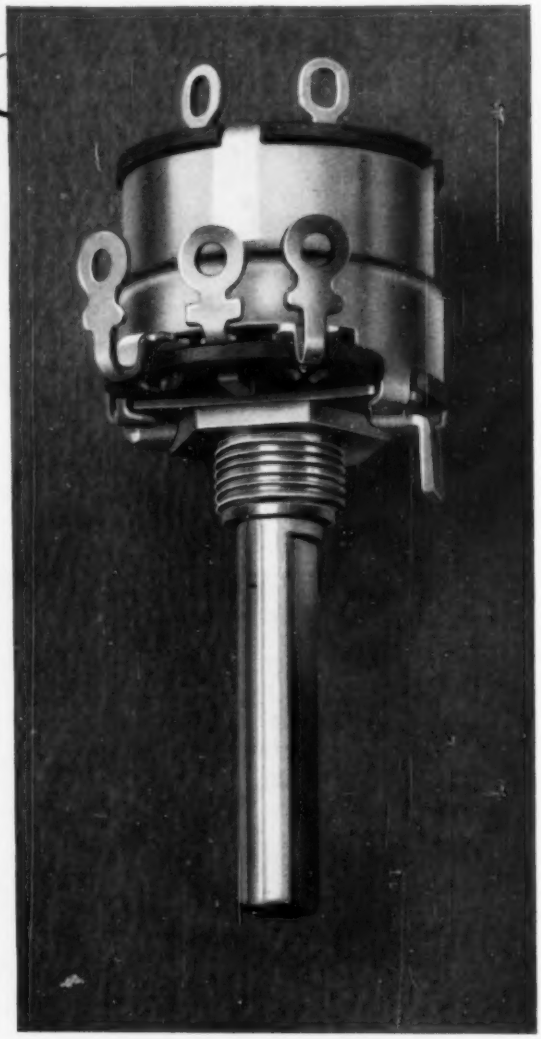
Recent reports from South Africa point to an affirmative answer to these questions, with some qualifications. After the usual amount of break-in troubles, the Sasol plant today is turning low-grade coal into 92 or 93 octane gasoline, plus diesel oil and valuable chemicals. Gasoline from the

Add New Convenience to Auto Radios

with this MALLORY

Pull-on . . . Push-off switch





GONE ARE THE DAYS of a car radio warming up to blast you out of the car while you fumble for the knob . . . and gone are the days of a car radio being turned on and running for hours, unheard because the volume control was not turned far enough!

The modern car radio is equipped with the new Mallory push-pull switch. Pull the volume control knob . . . with a gentle click, it's on—and the volume control setting is the same as when last turned off. Touch a finger tip to the face of the knob . . . with a gentle click, it's off—and the volume control setting remains unchanged for the next time the set will be used.

Mallory pioneered the vibrator which made auto radios practical. Now . . . Mallory has made it possible to add car radios to the growing list of controls and accessories that can be push-button controlled. This unique feature is just one more example of how manufacturers can depend on Mallory for the very latest design advancements in automotive radio components.

And a **new Mallory volume control for transistor radios**

This new control by Mallory has been especially designed for use in transistor receivers. It features extremely low "hop-off" resistance for smooth, precise control of transistor circuits at low volume levels. Another Mallory advance-design component for modern automotive listening pleasure.

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Sasol plant, operated by South African Coal Oil & Gas Corp. Ltd., is selling in the area for a cent a gallon less than competitive fuel.

Other areas are seriously studying plans for turning their coal into gasoline and petrochemicals. The experience at Sasol is that it can be done economically, if an area has ample coal and water—and consumes enough gasoline to warrant writing off a costly plant over a period of years.

The Sasol process basically consists of the gasification of coal by steam and oxygen into carbon monoxide and hydrogen; then processing this raw gas into hydrocarbons and by-product chemicals by equipment similar to that found in a conventional refinery.

Lump coal comes from a highly mechanized mine 2.5 kilometers away by conveyor. After passing through a crushing and screening station, the fines are conveyed to the power plant for fuel and the larger pieces move to the first step in process (chart on page 43), the gasification unit.

This consists of nine Lurgi gasifiers, one of them a spare. Each is a steel pressure shell encased in a jacket where some of the process steam is generated. Coal enters at the top of the gasifier, and steam and oxygen are introduced through a rotating grate at the bottom. The outgoing gases are scrubbed and then cooled.

The condensed liquid is flashed through cyclones and separated into two phases. The water phase moves to the phenosolvan and ammonium sulfate plants, where phenols and ammonia are extracted. The ammonia goes into the making of fertilizer.

The oil phase begins a long processing journey that accounts for most of the end products of the refinery. The first step is gas purification, where sulphur compounds, gums, and resin formers are removed, and carbon dioxide is reduced to about 1.5%. The gas is then ready for either of two synthesizing systems: the Arge unit, designed primarily for the manufacture of diesel oils and waxes; or the gas reforming station leading to the Kellogg synthesis unit, which accounts for most of Sasol's gasoline and petrochemicals.

The Sasol refinery has been designed so that it can easily change the ratio of gasoline and other products it produces. In times of shortages or national emergency, it can cut back on diesel oil output and turn out large quantities of aviation fuel.

The economics of the new refinery are somewhat peculiar to its location, though many other coal-rich countries have been watching the project with interest. What made the oil-from-coal plan attractive to the South African government was the area's extensive deposits of low-grade coal, and the high price of gasoline in Johannesburg when it is shipped over 600 kilometers from the nearest port. Also, there was the desire of the government to achieve some degree of independence from distance oil sources, in the event of war or other emergency.

Extensive coal reserves are spread out over most of Africa. Several areas of the continent, notably Belgian Congo and Rhodesia, are reported to be investigating the possibilities of using these reserves for the manufacture of oil products. ●

Quick Freeze for Rubber

Digested from AMERICAN MACHINIST, Nov. 18, p157

The "deep freeze" technique does an important job in food packaging, chemical processing, and some fields of research. Now, factory men are finding some other practical uses for quick, sudden changes in temperature.

Problem: How to remove flash, the paper-thin excess material that clings to soft-rubber and plastic molds. Removal normally is a costly process, often requiring hand filing or finishing with abrasive belts.

Solution: Quick freezing the parts by the expansion of carbon dioxide—dropping temperature in seconds to near −90 F—and then tumbling the molds against each other in six-sided revolving barrels. The bumping of the molds strips off the excess material without harming the product.

Such a deflashing system has been put to work by an American rubber seal manufacture, the Garlock Packing Co. Work that formerly took 120 hours of an operator's time now is done in a half hour.

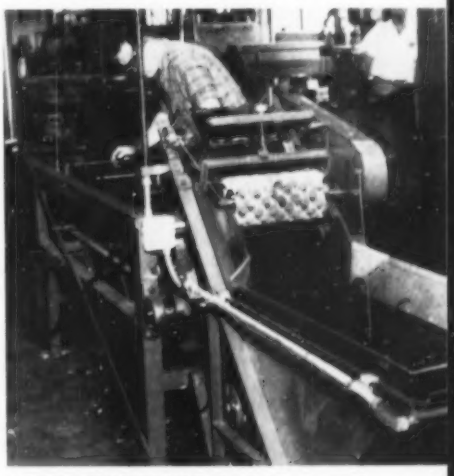
The tumbling cycle is a precise operation, with each type of part tumbled for its own given period of time to insure against product damage. Steel jacks are tumbled with the rubber parts when an excessive flash is present.

The tumblers have speed and temperature controls. Tumbling time varies according to the composition of the parts being processed. Soft compounds generally are more difficult to tumble than harder materials.

Silicone rubber parts are the only high-volume products made by Garlock that are not tumbled. They refuse to lose their flexibility even at the lowest temperature available by liquid carbon dioxide.

The general rule is that any part that can be put into barrels can be tumbled. Load quantities vary from 150 rubber rings measuring 30 to 33 centimeters in diameter to 40,000 small seals.

Main item in the freezing unit is an insulated tank holding about six tons of liquid carbon dioxide at 20-kilograms per square centimeter. A ¾-hp refrigeration unit, operating through coils in the main tank, maintains a temperature somewhat below room temperature so as to avoid too high a tank pressure. ●



AFTER TUMBLING, flash is removed on an agitating separator.

Industry is finally harnessing the powerful properties of sound for a wide range of processing and maintenance purposes. The four men at left are watching an ultrasonic drill cut a square hole through metal. Cleaning, gaging, soldering are other promising applications. Here are . . .

Seven Uses for Silent Sound

Digested from POWER, Dec., p131

Each month industry is finding practical new uses for electronically-produced sound waves. These high-frequency vibrations—pitched far above the limits of the human ear—have gone to work at cleaning carbureters and spark plugs, gaging metal thickness, reducing air pollution, as well as drilling, grinding, and soldering.

Here are seven different ways in which this handy tool is helping factories and machine shops:

Cleaning—Ultrasonic vibrations passing through a liquid produce cavitation — microscopic, high-speed rupture of the fluid—that aids in the cleaning and degreasing of everything from tiny mechanisms to rough foundry castings. Bits of soil clinging to an object are torn away by the agitated liquid with no harm to the piece being cleaned.

Cavitation gets into the tiniest spaces. As a result, motor armatures, turbine blades, fuel nozzles, and other devices can be perfectly cleaned without disassembly. Parts can be cleaned in dirty solvents, because drag-out of contaminant from solution is only 10% of normal.

Reasonably priced equipment is now available for batch or continuous cleaning systems. The process lends itself to complete automation. Conveyorized systems are used in metalworking and other industries.

Machining—Glass, metals, ceramics, and such hard materials as tungsten, titanium carbides or even diamond, can be machined with ultrasonic techniques. Holes are made by vibrating an abrasive slurry ahead of a shaped bit. Because the new tools reciprocate instead of rotate, they can make intricately shaped holes without fracturing or chipping the material.

Soldering — Cavitation set to work in molten solder can serve to break down the rapidly forming metal oxides on surfaces of nonferrous metals such as aluminum and magnesium. The result is a bond that is stronger than the base metal itself. Ultrasonic soldering has been found useful in splicing aluminum cables and wires, joining aluminum bus bars, and repairing cracked aluminum housings. It also makes reliable unions of copper and brass electrical parts.

Level Indicators—An ultrasonic device fixed at a set level in an oil or water tank can control shutoff, transfer, and feed when liquid level reaches the instrument. Upper and lower levels in a buried fuel tank, a boiler feedwater tank, or the boiler itself may be ultrasonically detected and controlled. Ultrasonic sensors are inexpensive and continuously indicate exact levels.

Material Testing—Common uses cover a range of materials from metal castings to rubber tires. Ultrasonic waves sent through metal produce an echo at the level of the crack or flaw. The technique enables maintenance men to probe into intricate assemblies that can not be readily inspected in normal practice.

Thickness Gage—In a like manner, silent sound measures inaccessible surfaces, sets mill rollers automatically, and tests effects of erosion and corrosion in pipes, hull plates, boiler plates, and tank walls.

Air Pollution—Silent sound also reduces industrial air pollution. Smoke exposed to intense sonic or ultrasonic energy tends to display particle agglomeration over a wide range of particle sizes. Devices powered by compressed air are expected to come into widespread use in industrial flues for controlling zinc-oxide and aluminum-oxide fumes, carbon black, tobacco smokes, and other obnoxious gaseous wastes. Valuable by-products also may be recovered with such systems. ●

COMBUSTION'S

SCHEDULE OF "Main Events" FOR '58

Dedication of World's Largest, Privately Owned, Integrated Facilities for Nuclear Research, Development and Manufacture

C-E's $15,000,000 Nuclear Division at Windsor, Connecticut. Ground broken December 1955; construction completed in late '57; dedication in Spring of '58.

Construction of Nuclear Submarine Prototype

At C-E Nuclear Division, Windsor, Connecticut. First nuclear submarine prototype to be designed and built at other than AEC-owned facilities.

Shipment of Largest and Most Complex Nuclear Vessel Built to Date

Reactor vessel for Enrico Fermi Nuclear Power Station.

Completion of Manufacture of World's Highest Pressure, Highest Temperature Boiler

5000 pounds per square inch; 1200 deg. Fahr.

Engineering and Partial Manufacture of World's Largest Boiler

First boiler ordered to serve a turbine generator with a capacity as high as 500,000 kw.

Completion of Installation of World's Highest Capacity, Highest Pressure, Highest Temperature Package Boilers

Two completely shop-assembled boilers, one with a capacity of 100,000 pounds of steam per hour, and one to operate at a pressure of 1800 pounds per square inch and 1050 deg. Fahr.

These are some of the achievements which will maintain Combustion's leadership in 1958 in its major field — the creation and building of advanced designs of equipment for the generation of power or heat from conventional or nuclear fuels.

And, in another significant area, Combustion expects to set a new record this year — *the largest volume of shipments and billings in its history.*

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Flame Cutting Goes Automatic

Good news for shipbuilders and other large users of profiled steel plate comes from London, where British Oxygen Gases Ltd. and Ferranti Ltd. have joined forces to produce a flame-cutting machine run by an electronic computer.

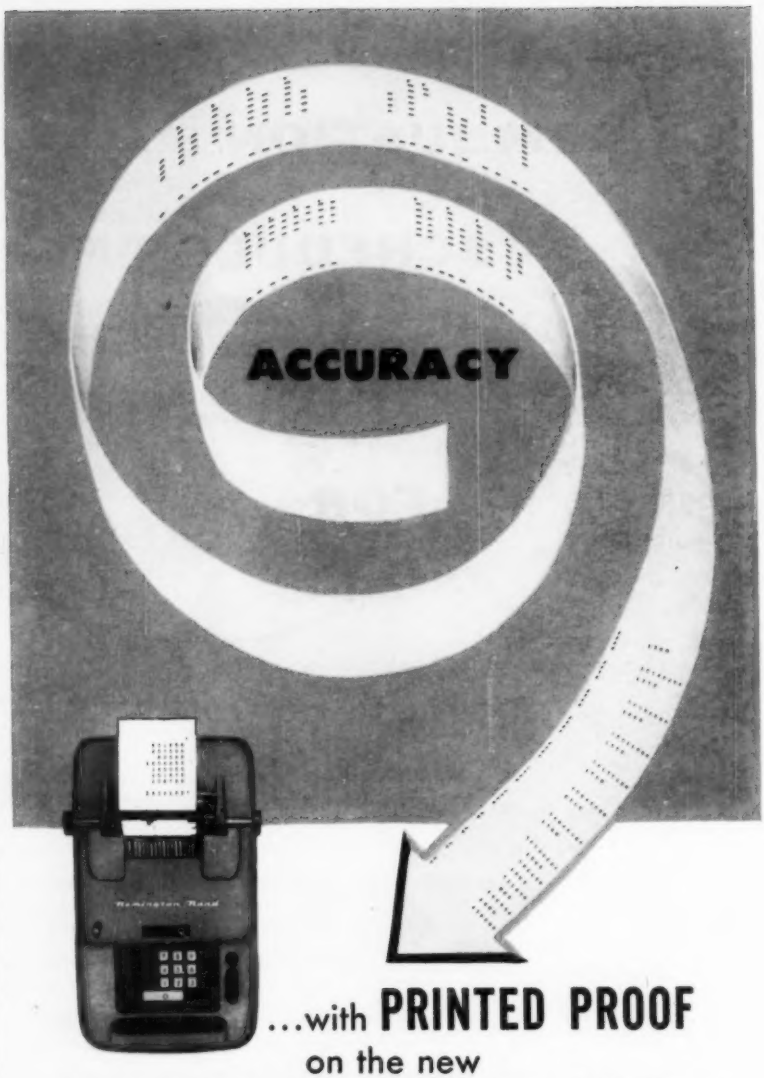
Still under development, the machine by-passes various stages between the drafting table and cutting operations. It eliminates the tiresome job of crawling about a mold loft marking ship plate. It also saves time and avoids the errors that occur in conventional methods.

The system starts with a standard drawing of the part to be cut; the difference is that the dimensions are given as coordinates of a datum point outside of the profile. These points are tabulated, and then the path of the cutting head and other machine instructions are coded by teleprinter on a punched tape.

Other controls are required to give the machine its precision and reliability. Included is a sensing unit that continuously monitors the height of the cutting nozzle above the work. There is also a flame monitoring device, and an automatic ignition unit that lights the gases on receipt of a command impulse from the control unit.

Operation of the system begins by pressing a button that positions the cutting nozzle over the datum point. The automatic ignition unit lights the pre-heat gases; after an appropriate interval, oxygen is supplied to the nozzle. A monitor indicates that all is well with the flame. Then the machine goes into action, directed by the coded tape. Data on the tape are converted into signals that run the servo motors controlling the cutting nozzle over the pre-calculated profile.

The prototype machine built by the two British firms handles plates as large as 180 by 210 centimeters, with the thicknesses up to 5 cm. Production models will be able to cut plates as large as 3.5 by 12 meters, and will have power driven rollers to move the plates into cutting position (*Metalworking Production, Dec.* 6, *p*2177).●



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Remington Rand simplicity of design and operation increase figuring speed — make office workloads light! Simplified 10-Key Keyboard assures you of fast, accurate figurework with a minimum of operator fatigue. Let your nearest Remington Rand Representative show you how 9 important features on the new "99" save you time, money and costly errors.

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Remington Rand Adders and Calculators available in 5 models with 2 different carriage widths to meet all your figuring needs.

SIMPLIFIES—SOLVES AND PROVES ALL FIGUREWORK

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Pfft!—Goes New Meat Sauce

Packers finally have conquered tricky problems of dispensing non-foaming foods in aerosols.

Digested from MODERN PACKAGING, Nov., p116

After ten years of failures and frustrations, U.S. food processors have successfully put a non-foaming product in an aerosol container. Previous food successes had been confined to whipped toppings. The pace-setting product is a "barbecue" (meat) sauce dispensed in semi-liquid non-aerated form, and marketed by Heublein, Inc., under the name Sizl-Spray.

The package is being studied with intense interest by other food processors who have long wanted push-button containers, if only their product could be expelled as a semi-liquid rather than a foam. The new sauce may lead to many foods in pressurized containers.

What primarily has held back food aerosols in the past has been the lack of a suitable propellent. The compressed-liquid propellents normally used in aerosols are not accepted for food use by American government authorities. The alternative is a compressed gas—nitrogen, carbon dioxide, and nitrous oxide. These until recently have had a record of being too soluble in products, the gas diminishing rapidly as the container is emptied and leaving as much as a third of the product behind.

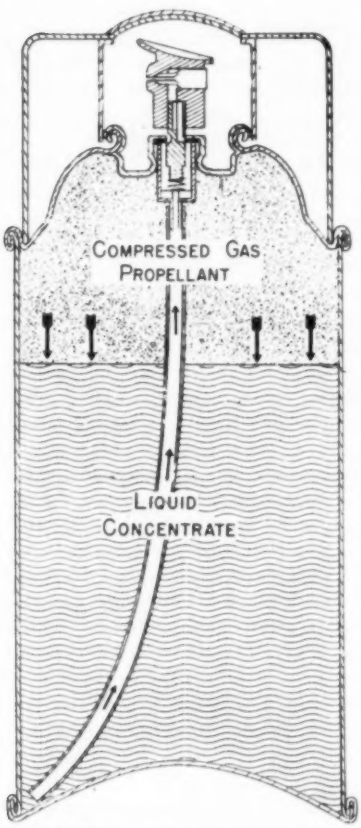
Another problem of food aerosols is that semi-solid ejections are hard to control, and require special applicators and valves. Foods that show the greatest promise for aerosol packaging often are viscous and have particles that tend to clog a tiny aerosol nozzle.

Heublein appears to have conquered both problems. The first success was the development of a sauce with light consistency and reduced pulp content. Particle size was reduced by homogenization.

For its propellent, the firm after much research settled for a prescribed mixture of carbon dioxide and nitrous oxide. Carbon dioxide normally creates a slightly acid taste in a product; nitrous oxide, a sweetish taste. The correct mixture, however, cancels out the objectionable flavor changes of both. The mixed gas is partially soluble in the sauce, but to such a slight degree that a minimum of the gas escapes and only less than 5% of the sauce is left in the can.

Aiding in the emptying of the can is a polyethylene tube (see drawing) that curves to the lowest level of the container. A dot of paint on the valve rim and a note on the label advises the buyer how to tip the can for effective emptying. Clogging is minimized by a self-cleaning actuator and valve.

Test-marketing of the meat sauce has proved encouraging to date. The firm packaging the sauce for Heublein is reported to be negotiating with other companies for such products as maple syrup, fruit concentrates, chocolate syrup, and cooking oils. ●



AEROSOL container features curved tube that minimizes product waste.

Highly Intimate Blends in 1 to 2 Minutes

Blends while discharging; No segregation or flotation

Sturtevant Rotary Blenders start 4-way blending while charging, continue it during discharge, thus producing highly intimate, even blends of dry and semi-dry materials – within 3 to 5 minutes of start of charging.

Six *complete* blending cycles per hour are common. And Sturtevant's special action produces no particle reduction, cleavage or attritional heat – is highly effective yet gentle and safe even with explosives.

Receiving

Scoops cascade material as drum rotates. Movement forces material from both ends to middle. Thus blending is 4-way right from start of charging.

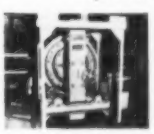
Discharging

Single gate controls charge, discharge. Blending continues throughout discharge phase. Result is no segregation or flotation — highly intimate, even blends.

Self-cleaning, dust-sealed drum; one-man accessibility

Operation of Sturtevant Blenders is self-cleaning – drum interiors are completely dust-sealed. For inspection of all models, one man simply loosens a few lugs to remove manhole cover – quickly and easily.

Nine standard models with capacities to 900 cu. ft.



10 cu. ft. Sturtevant Blender at U.S. Steel Corp.'s new Applied Research Laboratory (Raw Materials Division) in Monroeville, Pa. This unit handles batches up to 500 lbs. — is ideal for pilot work and small runs.

One of four 450 cu. ft. Sturtevant Blenders at Celriver Plant of Celanese Corp. (Rock Hill, N. C.). These large units handle up to 20,000 lbs. batches — have a 9-year record of meeting the most exacting blending requirements.

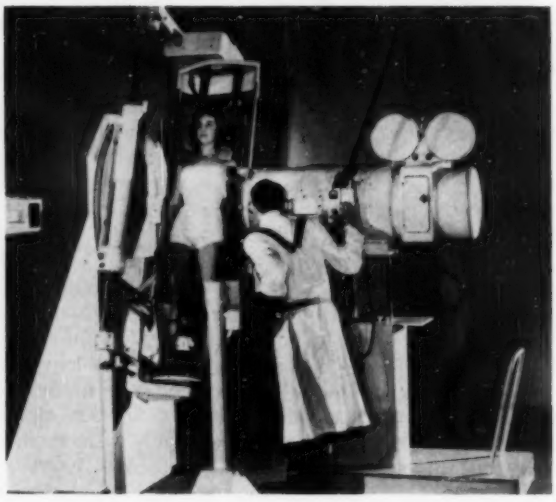
Fully or semi-automatic, or manually controlled operation

Constructed of carbon steel, stainless steel or Monel metal, Sturtevant Rotary Blenders are engineered to fit each customer's needs – can be supplied with injector sprays and any desired control system.

For more on Sturtevant Blenders, request Bulletin No. 080B. (Bulletins also available on Mixers, Air Separators, Micronizers, Crushers and Grinders.) Write today. STURTEVANT MILL CO., Clayton St., Boston, Mass.

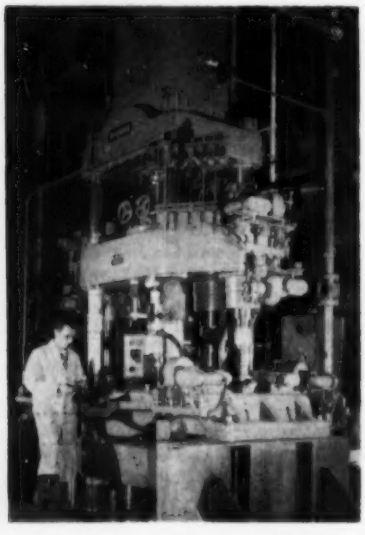
Looking Ahead in Technology

● **FLUOROSCOPIC MOTION PICTURES,** long desired for diagnostic purposes by radiologists, have been made possible by the image-intensifier camera assembly shown being adjusted by the technician in the photograph at right. A major obstacle of the past had been the prohibitive radiation dose required to produce bright images on large screens for filming at normal camera speeds. A device developed by Philips Lamp Co., Eindhoven, Netherlands, now overcomes this obstacle by using electron optics that intensify image brightness by more than 100 times. A photo cathode emits electrons at rates proportional to the intensity of fluorescence produced by the radiation. The patient undergoing diagnosis rests in a tray that moves vertically, laterally, and rotates on two axes. Cinefluorography is used to study gastrointestinal action and blood circulation. And there may be some important industrial applications. (*Product Engineering, Dec.* 9, *p*87)



● **A TREE HAS GROWN to nearly pulpwood size** in a matter of six years, in experiments conducted by the Ontario Paper Co. Ltd., Canada. The experimental tree is a hybrid poplar imported from Italy. Still to be determined is whether the tree will yield fiber of the desired quantity and quality and whether the tree will be sufficiently resistant to plant disease and rodent damage. (*The Paper Industry, Nov., p*748)

● **A 300-TON PRESS for compacting powder metals,** the largest of its kind ever built, recently was delivered by F. J. Stokes Corp., Philadelphia, U.S.A., to a big American metalworking firm. This hydraulic multiple-motion press (photo below) features servomechanism controls that permit widely-varied pressing speeds, so that parts of uniform density are produced. Large powdered metal parts now can be made to higher levels of accuracy and uniformity. Technological advances such as this press, Stokes executives say, make it possible to press heavily stressed gears, cams, and other complex parts at a price competitive with those produced by machining.



● **LINING A DAM with strips of polyethylene** is being tested as a water conservation method in Australia by the Commonwealth Scientific & Industrial Research Organization. Two strips of Visqueen sheeting were laid across an 180-meter-long experimental dam, and joined together on the spot with new heat-sealing equipment developed by Australia's Plastalon Pty. Ltd. Once it has been filled and tested for leaks, the dam will be used in the development of new techniques for controlling water losses by the Mansfield process of spreading cetyl alcohol on the water surface (MD, June 1957, p24). (*Chemical Week, Nov.* 30, *p*61)

● **AN INSTRUMENT that scans an industrial engine** while it is operating and gives a television-like picture of the engine's condition has been developed by U.S.A.'s Allen B. Du Mont Laboratories. Called the Industrial EnginScope, it indicates fouled and maladjusted sparkplugs, defective coils and wiring, worn distributor parts, and gives a running account of cylinder-by-cylinder timing, valve operation, and ignition effectiveness. A mechanic looks at a screen and sees a graphic picture of the operation of each cylinder in its proper firing order. He can find the source of trouble by comparing the action of cylinders.

● **MAGNETS of the future** will be made from a wide variety of materials, the product of choice depending on cost and the energy product (strength) and coercive force (permanence) required. What is new and promising in this field came out of a recent Conference on Magnetism and Magnetic Materials in Washington. The Alnico family still is the workhorse of permanent magnets: Alnico V, for high energy product; and Alnico VII, for high coercive force. Promising newcomers include: barium ferrite, which has a higher coercive force than an Alnico and is lighter and cheaper; manganese bismuth, which also has high coercive force but loses magnetic properties at low temperatures.

Tomorrow's permanent magnet may come from fine particles of pure iron or iron cobalt suspended

in a nonmagnetic matrix material

● **BEARINGS that combine the** the surface of the bearing, thereby

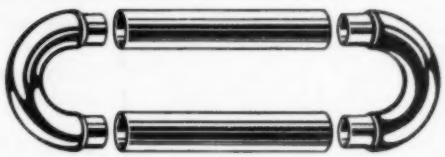
MUELLER BRASS CO. QUALITY PRODUCTS

for refrigeration and air conditioning heating and plumbing

One dependable source for all your requirements . . . from fittings to forgings

180° RETURN BENDS

A complete range of sizes for condensers, cooling coils, etc., with plain or cupped ends. Both O. D. wall thicknesses and center-to-center dimensions carefully matched to customer's specifications.

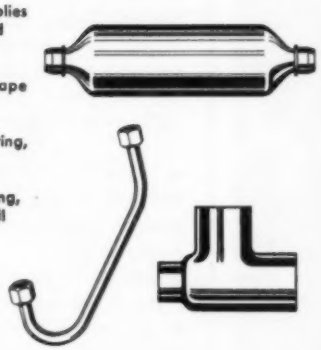


STANDARD AND REFRIGERATION TUBING

For all piping, refrigeration, and air conditioning requirements, Mueller Brass Co. Streamline copper tubing is available in all required wall thicknesses, and hard or soft tempers.

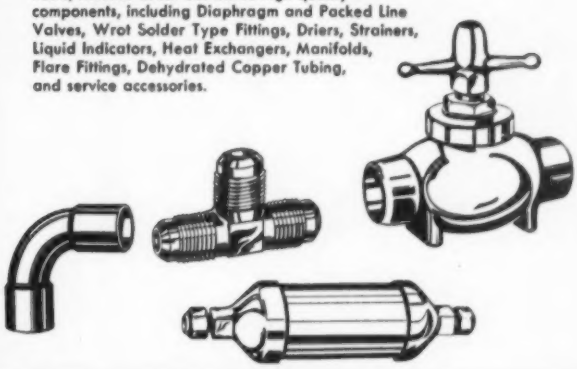
FORMED COPPER TUBE AND ASSEMBLIES

Mueller Brass Co. supplies formed copper tube and assemblies with special bending temper. Cut to customer's size and shape specifications. Complete facilities for swaging, bending, spinning, upsetting, flaring, flattening or sealing, beading and grooving, drilling, piercing, machining, joining . . . all at consistently close tolerances.



REFRIGERATION PRODUCTS

For virtually every refrigeration and air-conditioning need, Mueller Brass Co. offers high quality components, including Diaphragm and Packed Line Valves, Wrot Solder Type Fittings, Driers, Strainers, Liquid Indicators, Heat Exchangers, Manifolds, Flare Fittings, Dehydrated Copper Tubing, and service accessories.



APPLICATIONS

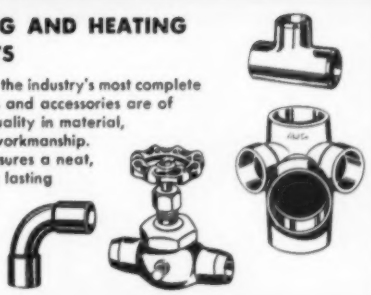
For sugar and paper mills, breweries, distillers, and other industrial applications, Mueller Brass Co. copper tubing is supplied to customers' specifications.

PACKING

Mueller Brass Co. can pack mixed groups of items for delivery to different job sites for any customer—an added saving to you by reducing rehandling costs.

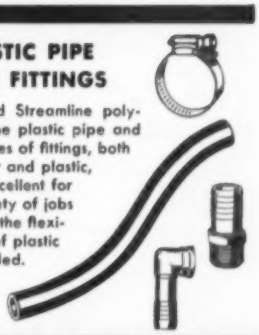
PLUMBING AND HEATING PRODUCTS

"Streamline", the industry's most complete line of fittings and accessories are of the highest quality in material, design, and workmanship. Streamline assures a neat, efficient, long lasting installation.



PLASTIC PIPE AND FITTINGS

Rugged Streamline polyethylene plastic pipe and all types of fittings, both copper and plastic, are excellent for a variety of jobs where the flexibility of plastic is needed.



203

40 OUR 40TH YEAR MUELLER BRASS CO. 1917-1957

MUELLER BRASS CO. **Port Huron 43, Michigan, U.S.A.**

Cable address: Streamline

in a nonmagnetic matrix material. Still in development stage, this material exhibits excellent magnetic properties and amazing versatility. Variation in the material's composition can give either high coercive force or high energy product. Strength and machinability of the final product are dependent on the nonmagnetic binder. With proper selection of binder, the material can be soldered, tapped, drilled, machined, or cut with an ordinary pocket knife. (*Product Engineering, Dec.* 2, *p*34)

● **BEARINGS that combine the lightness and strength of aluminum** with the good bearing surface of tin—and don't scratch shafts—are being produced by Glacier Metal Co., England, according to the English Tin Research Institute. The alloy consists of 20% tin and 80% aluminum, strengthened with a small additive of copper. Each metal retains its identity in the alloy. When the shaft metal heats and softens to the point where it might be scratched by the harder aluminum, the tin softens and comes to the surface of the bearing, thereby protecting the shaft. (*Business Week, Dec.* 14, *p*92)

● **USES OF GALLIUM, a metal with varied properties,** were featured by Aluminum Co. of America (Alcoa) at the recent Chemical Industries Exposition in New York. Gallium arsenide and gallium phosphide are scheduled for use in transistors, diodes, rectifiers, and other semi-conductor devices. Alcoa can produce gallium of better than 99.995 per cent purity. The metal melts from the heat of a person's hand, but does not boil until heated to about 3600 F. Unlike most elements, gallium expands when it solidifies.

● **PAPER PULP is being made from cotton and grape stalks** in the $3.5-million factory of the Kerncot Fiber Corp., California, U. S. A. By next fall the plant, now in experimental operation, will be turning cotton stalks and grapevine trimmings from local farms into 150 tons of pulp per day. Raw material is chopped into pieces about 2 centimeters large, then soaked in an NaOH bath for a few hours. Subsequent defiberizing and processing are standard pulping operations. (*Chemical Engineering, Dec., p*162)

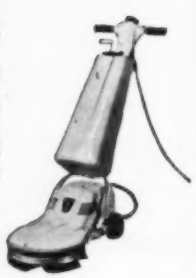
● **RAYON will be derived from bamboo** in a $15-million pulp plant soon to be erected in India by Japanese engineers. The process was developed by professor Hasao Horio, dean of the engineering department of Japan's Kyoto University, at the request of the Indian government. Professor Michihiro Takahama, also of Kyoto, is preparing a detailed plan for the projected rayon pulp plant.

● **RUSSIA'S new ZIL-120FB auto engine**—6 cylinders and 115 horsepower—features twin carburetors. One feeds a weak fuel mixture to the cylinder in the usual manner; the other, a rich mixture to the supercharger through a special channel provided in the engine block. The rich mixture is ignited in an antechamber; then injected into the cylinder under pressure, where it ignites the weak mixture. Russians say the system results in 25% fuel savings. (*Product Engineering, Dec.* 9, *p*9)

DOWN SHE GOES

THE SOLO FINDS NEW PLACES TO POLISH & SCRUB . . . .

Revolutionary in design the SOLO Polisher/Scrubber is noiseless and, despite its light weight and low price, is capable of continuous heavy work. A special feature is the low build and adjustable handle which makes it easy for the operator to polish or scrub under desks, beds and furniture. The mechanism is reversible, thereby doubling the life of brushes and there is virtually no maintenance required. The SOLO is ideal for use in smaller hotels, clubs, nursing homes, cottage hospitals, small works, public houses, etc.



The addition of a tank converts the SOLO into an efficient Scrubber.

DESIGNED AND MANUFACTURED BY

Cimex-Fraser Tuson Ltd.

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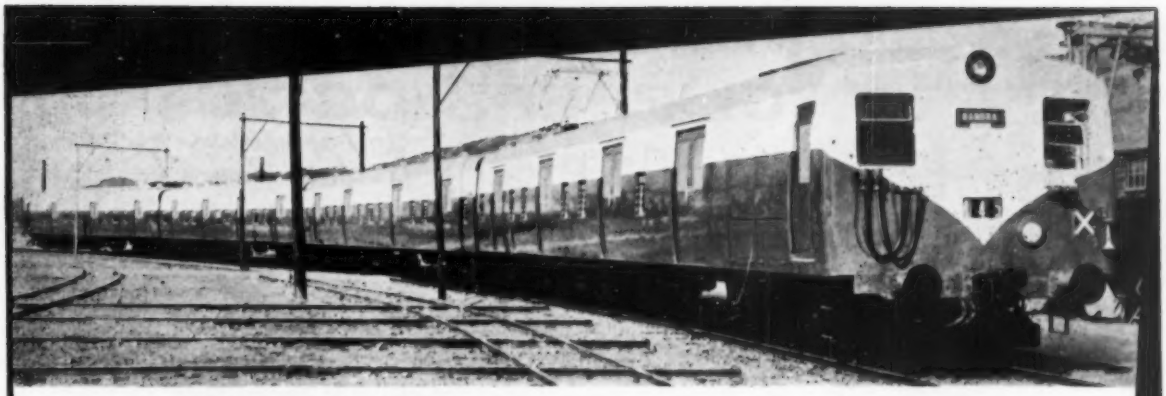

EMU Coaches, supplied to Western Railway, Bombay

WORLD TESTED STURDY
HITACHI'S
LOCOMOTIVES
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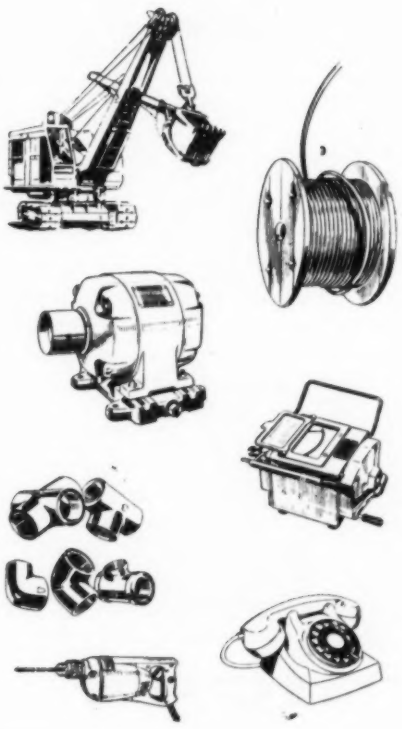
CARS

1,900 HP Diesel Electric Locomotive supplied to J.N.R.

ELECTRIC (A.C. & D.C.) LOCOMOTIVES
DIESEL-ELECTRIC (DEL) LOCOMOTIVES
STEAM LOCOMOTIVES
BATTERY LOCOMOTIVES
ELECTRIC CARS
FREIGHT CARS
GASOLINE CARS
TROLLEY BUSES
PASSENGER CARS
TANK CARS
DIESEL CARS



Hitachi Excitron Mercury Rectifier Type A.C. Locomotive supplied to J.N.R.

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DESIGNED FOR TODAY

"SUPER-7" CLIPPERS (DC-7Cs)

BEST WAY TO THE U.S.A.

"Super-7" Clippers—the envy of aircraft designers—the last major development in piston-driven aircraft.

Four turbo-compound engines develop 17,400 horsepower.

Only Pan American has made over 65,000 transatlantic crossings.

Radar picks out the smoothest path through the skies for a radius of 150 miles.

Both first-class *President* and tourist-fare *Rainbow* service—each the most popular in its class—are available on Pan American's "Super-7" Clippers.

"Super-7s" are the world's standard in fast overocean airliners. Pan American holds 18 transatlantic speed records.

Pan American has pioneered the commercial aviation uses of Ground Control Approach Systems, Long-Range Radio Aids to Navigation, Scientific weather forecasting, Engine analyzing instruments and radar.

When you're in a hurry to get to the U.S.A.—or anywhere else in the world—make your first choice one of Pan American's record-breaking "Super-7" Clippers*.

Pan American flies more of these Douglas-built DC-7Cs than almost all other airlines combined. Both first-class *President* and tourist-fare *Rainbow* services are available aboard the "Super-7" Clippers.

While the smooth-working crew up on the flight deck sends your "Super-7" racing through the sky, back in the cabin you'll enjoy the world standard of superior service in the air. Meals served aboard the Clippers have recently been awarded three prizes by a jury of world-famous gourmets and chefs at the International Culinary Exhibition in Frankfurt.

And whatever your origin, Pan American—*host to the world*—makes you feel perfectly at home. For instance, 36 languages are spoken by flight service personnel on Pan American's transatlantic services alone; many speak three and four languages.

Remember, too, when you go by Clipper you are in the hands of million-milers. Over 1400 Pan American pilots have flown over one million miles each . . . almost 150, more than three million.

For reservations, call your Travel Agent or Pan American—600 offices throughout the world.

*TRADE-MARK, REG. U. S. PAT. OFF.

PAN AMERICAN

WORLD'S MOST EXPERIENCED AIRLINE

Taking temperatures with a camera is a novel idea with exciting applications for industry. Pictures on right show the same refinery—not by day and by night but as seen with an ordinary and then an infrared camera. Note "hot spots" in central tower.

"Hot Spots" Take Their Own Picture

The process is not new, but the design of the Far Infrared Camera is. It's a new adaptation of a basic infrared camera designed for U. S. military use, and only recently were secrecy restrictions lifted to allow industrial use.

The Far Infrared Camera (picture below) is designed for "heat" photography involving low temperature. Unlike other infrared detectors, which are limited to objects at temperatures of 1000° F or more, it will quantitatively analyze complete areas at temperatures from 500° F to below 0° F. Black and white shadings in the finished X-ray-like picture are produced by gradations in the amount of infrared energy emitted by the object, rather than by the amount of visual light it reflects.

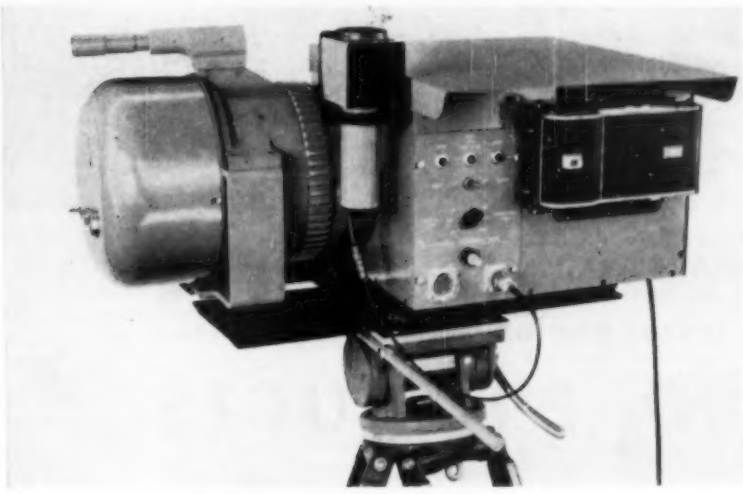
Two main parts make up the unit—a standard 8-inch Optitherm Radiometer and a scanning attachment. Located in the attachment is a large plane mirror mounted on a pivot system that permits both horizontal and vertical deflection. This mirror deflects the optical beam of the radiometer and thus scans the small area subtended by the infrared detector over the object plane. A smaller mirror attached to the back of the scanning mirror deflects the light beam from a small glow tube on to a photosensitive film.

No special film is required, but Polaroid Land Film is said to give the quickest results. Because the two mirrors are in exact synchronism, and because the beam of the glow tube is modulated by the radiometer output, a thermal image of the objects in the general field of view is formed. During the rapid horizontal return of the scanner a blanking circuit cuts off the glow tube output to avoid retrace lines.

A finished picture can be ready for analysis 1 minute after the scanning cycle is completed. Total scanning time is adjustable to application requirements—e.g. the overall field of view, sensitivity to small temperature differences—and may vary from about 1 to 14 minutes. The instrument detects differences as small as 0.04° F with a 15-minute scan, up to 0.4° F with a 2-minute scan.

Perhaps the widest application for thermal photography is in industrial scanning. A heat picture of a refinery, for instance, like the one shown top right, can show up undesirable "hot spots"; a picture of electrical switchgear will reveal overloading or poor switch contacts. The detection of abnormal heat patterns in electronic equipment, welded structures, machine parts, and metal castings could also be used as a means of improving quality control.

Cost of the camera will at first be in the $15,000-$25,000 range. **Barnes Eng. Co., 30 Commerce Rd., Stamford, Connecticut, U. S. A.**



INFRARED camera has optitherm radiometer on left, film pack on right.

"WHITE-HOT" pipe, cold hair, ears.

Get a better return on your investment...

Euclid TWIN-POWER

The use of Twin-Power in earthmoving equipment, developed and pioneered by Euclid, has enabled contractors, mines, quarries and industrial operations to make a far better return on their equipment investment. With two engines, each having a separate power train, bigger loads are moved faster and at lower cost . . . with only one operator.

Euclid's Twin-Power Scraper is a good example of this advanced engineering. With struck capacity of 24 cu. yds.—and 32 yds. heaped—this machine can work independently without the pusher tractor assistance required by conventional scrapers. All wheel drive, powered by two engines providing a total of 518 h. p. through two Torqmatic Drives, gives this "Euc" unequalled work-ability. "Twins" have established new records for high production at low cost on a wide range of work.

Twin-Power performance pays off in other Euclid equipment, too—crawler tractors and in rear-dump haulers of 40 and 50 ton payload capacities. If you use earthmoving equipment in your operations, Euclid Twin-Power may have an application that will produce a higher return on your investment. Complete information with technical assistance of an equipment specialist is available without obligation.

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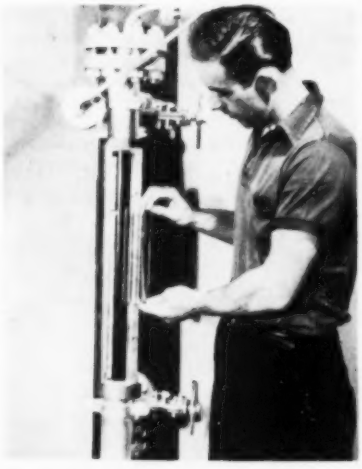
EUCLID (GREAT BRITAIN) LIMITED • Newhouse, Lanarkshire, Scotland

EUCLID PRODUCTS

Heavy-Duty Stapler

The pneumatic stapler shown above is capable of fastening tough fiberboard as well as other materials such as soft matting and burlap. The machine takes staples with crowns up to 1⅜ inches long and legs of ½, ⅝, or ¾ inch.

Air requirements are 60 to 100 pounds per square inch. The stapler air line can be fastened into any air line below 100 psi. **Container Stapling Corp., P. O. Box 247, Herrin, Illinois, U. S. A.**



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This steam-boiler water-level gage for ships and power plants is designed to remain readable at all temperatures. The manufacturer claims that it cannot explode, and that it can be set up to operate controls automatically.

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The very capacitive dustbag can easily be taken out vertically.
A range of special accessories has been designed for particular applications. The versatility of the machine therefore is almost unlimited.

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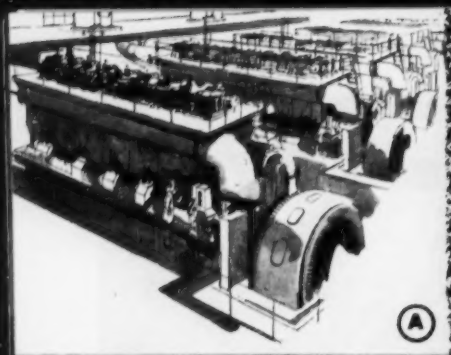

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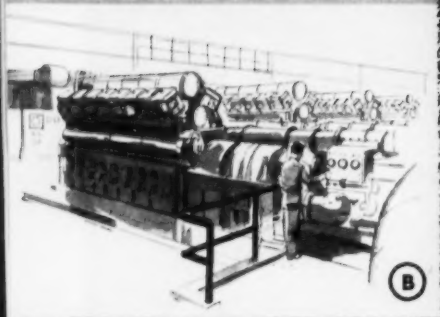

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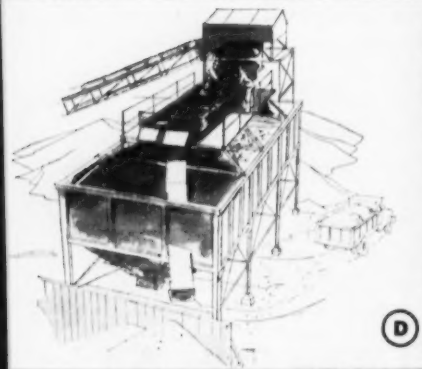

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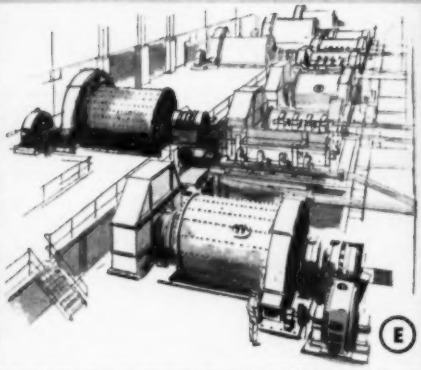

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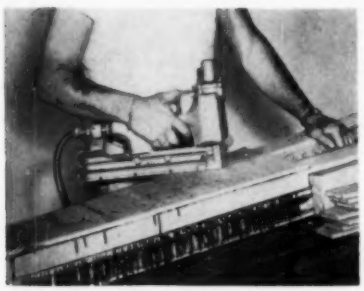
less steel in place of the usual breakable glass or quartz tube. The pipe encloses a metal float (held by the operator) which carries a powerful magnet. As the float rides up and down on the water in the tube, the magnet acts through the pipe wall upon white-painted metal reeds which can be seen through the window on the front of the gage. When the float moves again the reed recedes out of sight. **Charles Engelhard, Inc., 850 Passaic Ave., East Newark, New Jersey, U. S. A.**



Automatic Nailer

The OHL Spotnailer works as fast as the operator can press the button. It is claimed to drive 1½-inch fasteners (the equivalent of 6d nails) into the hardest of woods without recoil. The gun is completely pneumatic, and has no piston-return springs. No more than 100 pounds per square inch are needed for the tool, and on a cubic-foot per minute basis is uses very little air. **Spotnails, Inc., 1527 Lyons St., Evanston, Illinois, U. S. A.**

Typewriter with a Memory

A new Swedish machine illustrates the trend towards "easier" typewriters—easier, that is, for both typist and typewriter mechanic. Innovations include a "Multimatic Tabulator" which acts as a mechanical memory as well as tabulating in the usual way. Its 20 fixed, pre-set stops can be controlled by a single lever. There is also a mechanism for releasing jammed keys: Located to the left of the space bar, it clears tangled keys instantly. **Atvidabergs Industrier, A. B., Kungstradgardsg 20, Stockholm, Sweden.**

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LOW-COST
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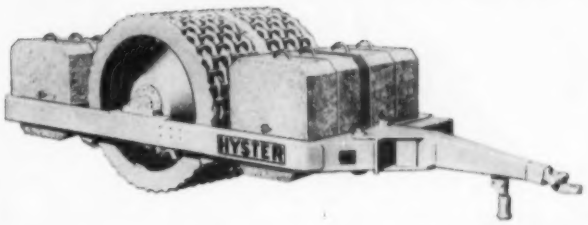
EFFICIENT
BITUMINOUS SALVAGE



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Here is the machine road builders all over the world are using on all types of road construction—freeways, secondary roads, farm-to-market roads, access and logging roads.

Built for long life on any job — rock surfacing haul roads or high-speed compaction on expressways — the "Grid" roller is designed to give you low cost operation and maintenance. Its high capacity tapered roller bearings give long life. Its high-strength cast steel wheels resist wear in rock and abrasive materials. The heavy-duty frame prevents distortion in the toughest going.

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3 BITUMINOUS SALVAGE — Quickly breaking down old ripped-up mat, the "Grid" Roller salvages all of the original aggregate and reusable binder for use in new surface.

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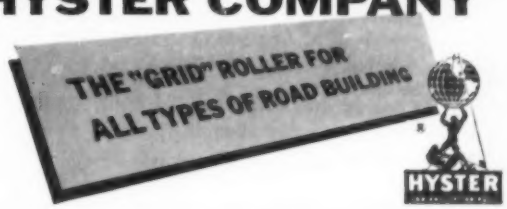

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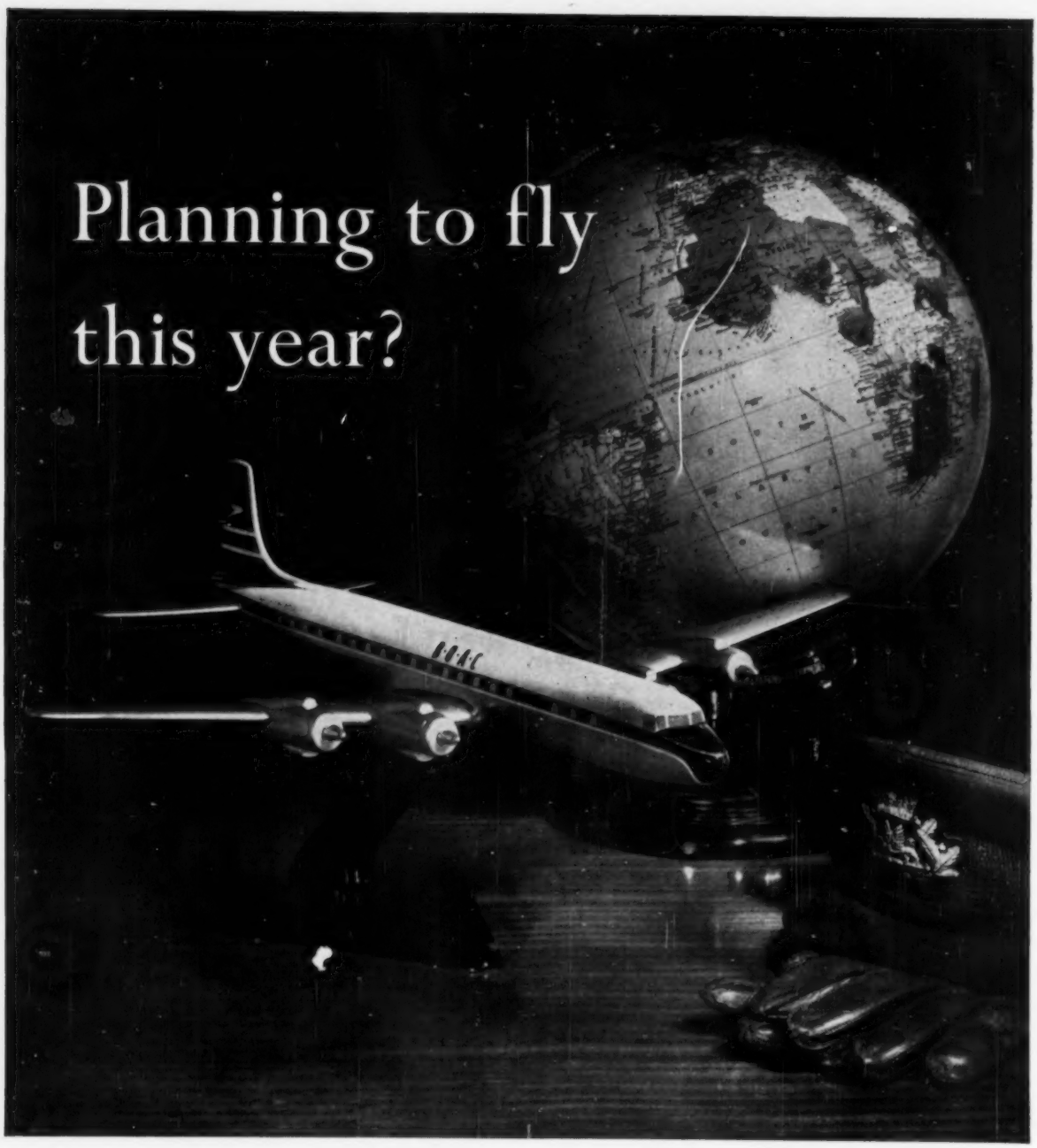

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Taping Mixed Size Boxes

A new line of electronically controlled carton closure equipment has just been introduced.

Where box sizes vary frequently as they come to the packing or taping station, a fully automatic case taper cannot be used because it would have to be readjusted constantly as box sizes change. "Boxize" Tape-O-Matic is the nearest approach to automatic case sealing in such installations.

Each box measures its own tape lengths and automatically feeds them from the motor drive dispenser in the most convenient position for manual application to the box. **Better Packages, Inc., Shelton, Connecticut, U.S.A.**

New Industrial and Medical Betatron

A Japanese company has just developed its first full-scale industrial atomic tool—a betatron which will find its use in X-raying industrial equipment as well as in the treatment of cancer (MD, Product Digest, Aug. '57).

The accelerator discharges 13-million electron volts to bombard the tungsten target, releasing rays of 20 roentgens at a 3-foot distance which are said to be strong enough to penetrate steel sheets nearly 4 inches thick. Weight of the betatron is half a ton, or nearly one eighth that of its overseas counterparts. **Tokyo-Shibaura Electric Co., Tokyo, Japan.**

Carries the Voice

The megaphone shown above consists of a detachable microphone, amplifier, batteries, and speaker—the whole weighing only 8 pounds. The Motorola Power Voice megaphone, as it is called, has a range of ½- to ¾-mile and is powered by standard flashlight batteries and 6 transistors. **Motorola, Inc., 4501 W. Augusta Blvd., Chicago, Illinois, U.S.A.**

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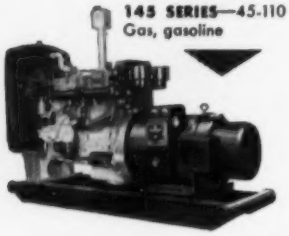

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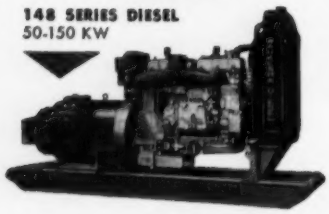
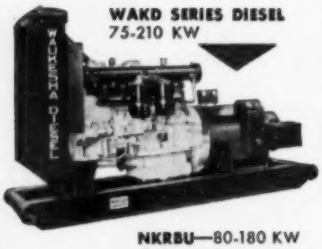
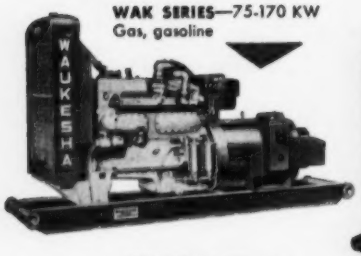


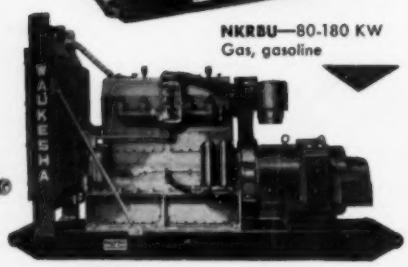
WAKD SERIES DIESEL
75-210 KW



WAK SERIES—75-170 KW
Gas, gasoline



NKRBU—80-180 KW
Gas, gasoline



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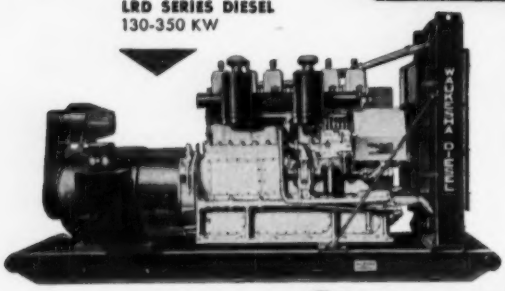

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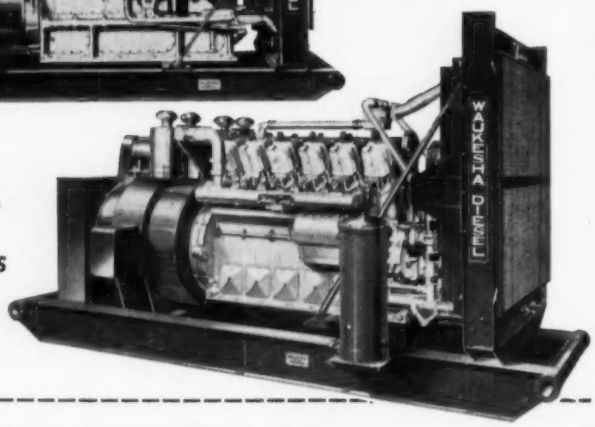

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WAUKESHA MOTOR COMPANY • WAUKESHA, WIS., U. S. A. *EXPORT DEPT.*

New Molding Plastic Enters the Lists

Polypropylene, the new plastic material whose development made headlines in 1956 (MD, Aug.'56, p11), is now going to market on both sides of the Atlantic. The principal producers are:

—**Montecatini of Italy (Societa Generale per l'Industria Mineraria e Chimica, Via V. Turati 18, Milan),** now preparing to export to the U. S. and other countries;

—**Farbwerke Hoechst of Germany (Frankfurt/Main),** who is now starting large-scale production and

—**Hercules Powder Co. of the U. S. (917 Market St., Wilmington 99, Delaware),** who has begun the first commercial manufacture of the resin in that country.

The new polymer is made from propylene, a petrochemical that has been regarded as a by-product of gasoline refining. A so-called thermoplastic, it melts at high temperatures, but retains strength at temperatures well above the boiling point of water. Like polyethylene, the booming plastic to which it is closely related, polypropylene is chemically inert, but it possesses mechanical properties similar to those of nylon molding resins.

The chief problem in the development of polypropylene has been its instability, but both Montecatini and Hercules have announced—to a somewhat skeptical industry—that this difficulty has been mastered.

All three manufacturers claim that the strength and molding characteristics of polypropylene should bring it a healthy market. Housekeeping and medical articles, pipes, electrical, automotive, and chemical equipment are the chief forms in which the new resin has so far appeared. But Montecatini in particular foresees many wider uses, especially in the field of textiles.

However desirable its properties, though, experts in the chemical industry think it improbable that polypropylene will usurp the whole polyolefin field. Once its inherent instability has been definitely conquered, it is more likely to complement existing molding plastics. ●

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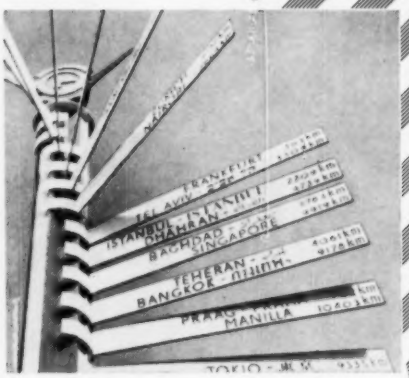

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● YOUR MANAGEMENT READING

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The Factory of Tomorrow—"Automation and Management"—to be published early in 1958—describes the evolutionary nature of production techniques, and explores the four important aspects of automatic manufacturing—maintenance, labor, sales, and management. The price—about $10.00. (Division of Research, Harvard Business School, Soldiers Field, Boston 63, Massachusetts; or Bailey Bros. & Swinfen Ltd., Hyde House, West Central Street, London W.C. 1, England.) . . ."Toward the Factory of the Future" describes how several leading American manufacturers are adapting automation to their operations. $2.50. (American Management Association, 1515 Broadway, New York 36, New York.)

Understanding the Dollar—"The World Dollar Problem" is a new book for the thoughtful international banker, trader, or businessman. It explains the "why" behind dollar shortages of the past, and considers the prospects for the dollar and world trade in years to come. $12.50. (St. Martins Press, 103 Park Ave., New York, New York.)

Finance in Industry—"The Financial Approach to Industrial Operations" explains some of the intricacies of financial decision-making in modern industry, 23 pages, $1.50. (Research Division, Society for Advancement of Management, 74 Fifth Avenue, New York 11, New York.)

Chemicals, A-Z—Chemical Week's annual report contains formulas, chemical properties, suggested uses, and availability of 483 chemicals and specialty products—from "Accobond" to "Zytel"—that were introduced in 1957. $1.00. (Management Digest, 330 West 42nd Street, New York 36, New York.)

Bulletins from Industry—Handy guides for measuring filing costs, and a detailed plan to improve filing efficiency are given in a 28-page manual. (Remington Rand Intl., 315 Fourth Avenue, New York 10, New York.) . . . Bulletin 234 describes Clearing's Series 'S' straight side crankshaft presses available in 50 to 300 tons capacity. (Clearing Machine Corp., 6499 W. 65th Street, Chicago 38, Illinois) . . . Fact-filled brochure describes the properties and performance of Dow Corning silicone coatings for paper and paperboard. (Dow Corning Corp., Midland, Michigan.)

Success Stories—"Adventures In Small Business" relates 119 case histories of individual businessmen whose ideas, products, and inventions have become profit-making enterprises. 273 pages, $3.75. (McGraw-Hill Book Company, 330 West 42nd Street, New York 36, New York.)

Handy Handbooks—The "Engineering Materials Handbook" is an encyclopedia of metals and materials—their properties, adaptations, advantages, limitations, competition with each other. 1936 pages, $21.50. (McGraw-Hill Book Company, 330 West 42nd Street, New York 36, New York.) . . . "The Concise Guide to Plastics" covers the selection, uses, properties, cost, and American sources of plastics. It might help you decide which material is best for your product. 320 pages, $6.95. (Reinhold Book Division, 430 Park Avenue, New York 22, New York.)

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American Automobile
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American Machinist
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Metalworking Production (London)
National Nucleonics
Petroleum News
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Product Engineering
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Today's Secretary

McGraw-Hill Publishing Co., Inc. 330 W. 42nd St., New York 36, N. Y.

American Builder, Marine Engineering, Railway Age, Railway Track and Structures, Railway Locomotive and Cars, Railway Signaling & Communications
Simmons-Boardman Publishing Corp., 30 Church St., New York 17, N. Y.

American Business
Dartnell Publications, Inc., 4660 Ravenswood Ave., Chicago 40, Ill.

Architectural Record
F. W. Dodge Corp., 191 W. 40th St., New York 18, N. Y.

Banking
American Bankers Association, 12 E. 36th St., New York 16, N. Y.

Business
Business Publications Ltd., Mercury House, 109-119 Waterloo Road, London, S. E. 1.

Ceramic Industry
Industrial Publications, Inc., 5 South Wabash Ave., Chicago 3, Ill.

The Controller
Controllers Institute of America, Inc., Two Park Ave., New York 16, N. Y.

The Economist
The Economist Newspaper, Ltd., 22 Ryder St., London, S. W. 1.

Harvard Business Review
Harvard University, Soldiers Field, Boston 63, Mass.

Heating, Piping & Air Conditioning
Keeney Publishing Co., 6 N. Michigan Ave., Chicago 2, Ill.

Industrial Marketing
Advertising Publications, Inc., 200 E. Illinois St., Chicago 11, Ill.

The Management Review, Personnel, Supervisory Management
American Management Association, 1515 Broadway, New York 36, N. Y.

Metal Progress
American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio

Modern Packaging, Modern Plastics
Breskin Publications, 575 Madison Ave., New York 22, N. Y.

The Paper Industry
Fritz Publications, Inc., 431 S. Dearborn St., Chicago 5, Ill.

Petroleum Press Service
Petroleum Press Service 91 & 93 Bishopsgate, London, E. C. 2

Plastics, The British Motor Ship
Temple Press, Ltd., Bowling Green Lane, London, E. C. 1

Printers' Ink
Printers' Ink Publishing Co., Inc., 205 E. 42nd St., New York 17, N. Y.

The Rubber and Plastic Age
Rubber and Technical Pres, Ltd., Gaywood House, Great Peter St., London, S. W. 1

Sales Management
Bill Brothers Publishing Corp., 386 Fourth Ave., New York 16, N. Y.

The Times Review of Industry
The Times Publishing Co., Ltd., Printing House Square, London, E. C. 4

Welding Engineer
Welding Engineer Publications, Inc., P. O. Box 28, Morton Grove, Ill.

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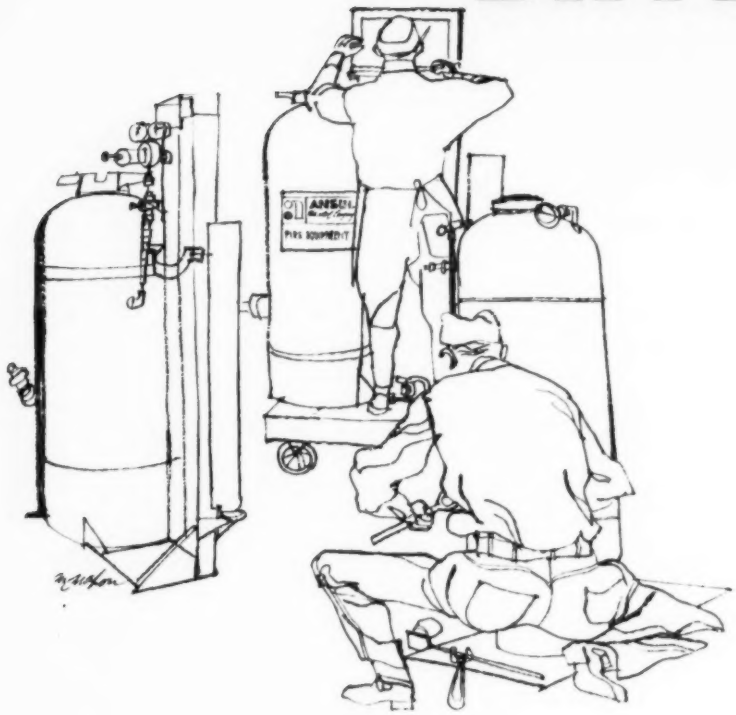

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